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CONTENTS OF VOLUME VIII

JULY, 1914. NUMBER 1

PAGE

STUDIES IN THE RESPIRATORY EXCHANGE OF INFANTS. FRANCIS G. BENEDICT AND FRITZ B. TALBOT, BOSTON 1

A CASE OF ACUTE CHYLOUS ASCITES (NON-FATTY, PSEUDOCHYLOUS, LACTESCENT OR MILKY TYPE) IN A BOY EIGHT YEARS OLD. FRANCIS HUBER, M.D., NEW YORK. OPERATIONS AND SURGICAL COMMENTS BY HENRY M. SILVER, M.D., NEW YORK 50

PROGRESS IN PEDIATRICS: REVIEW OF THE LITERATURE ON THE FEEDING AND GASTRO-INTESTINAL DISEASES OF INFANTS, FOR THE YEAR 1913-1914. GRACE MEIGS, M.D., CHICAGO 58

REVIEW OF SYPHILIS WITH ESPECIAL RELATION TO HEREDITARY SYPHILIS. HARVEY PARKER TOWLE, M.D., BOSTON 95

INDEX TO CURRENT PEDIATRIC LITERATURE 105

AUGUST, 1914. NUMBER 2

PAGE

PRIMARY PULMONARY ACTINOMYCOSIS IN A CHILD AGED TEN, WITH POST-MORTEM EXAMINATION. FRANCIS HUBER, M.D., AND SAMUEL BERKOWITZ, M.D., NEW YORK 113

CASEIN IN INFANT-FEEDING: THE PREPARATION OF DRY POWDERED PARACASEIN AND PRELIMINARY EXPERIMENTS CONCERNING ITS USE AS THE PRINCIPAL PROTEIN CONSTITUENT IN INFANT FOOD. A. W. BOSWORTH, A.M., GENEVA, N. Y., AND HENRY I. BOWDITCH, M.D., BOSTON, WITH THE ASSISTANCE OF B. H. RAGLE, A.B. 120

THE PRESENCE OF LACTIC ACID IN THE URINE IN CYCLIC VOMITING OF CHILDHOOD. FRANK P. UNDERHILL AND H. MERRIAM STEELE, M.D., NEW HAVEN, CONN. 127

A CLINICAL STUDY OF TYPHOID FEVER IN CHILDREN. HENRY DWIGHT CHAPIN, M.D., NEW YORK 130

DIAGNOSIS OF WHOOPING-COUGH BY THE COMPLEMENT-DEVIATION TEST. ALFRED FRIEDLANDER, M.D., AND E. A. WAGNER, M.D., CINCINNATI 138

THE ARTIFICIAL COOLING OF SICK-ROOMS IN SUMMER. A PRELIMINARY REPORT. HENRY HEIMAN, M.D., NEW YORK 138

CIRCUMCISION IN THE MASTURBATION OF FEMALE INFANTS. ROWLAND G. FREEMAN, M.D., NEW YORK 144

MIDDLE EAR COMPLICATIONS OF MEASLES IN IMMIGRANT CHILDREN. H. G. CODY, M.D., U. S. PUBLIC HEALTH SERVICE, ELLIS ISLAND 147

A CASE OF TUBERCULOUS MENINGITIS COMPLICATED BY INFLUENZAL MENINGITIS. H. K. FABER, M.D., NEW YORK 150

PROGRESS IN PEDIATRICS: ACTIVE IMMUNIZATION AGAINST DIPHTHERIA BY MEANS OF VON BEHRING'S VACCINE, AND THE DIPHTHERIA TOXIN SKIN REACTION. BORDEN S. VEEDER, M.D., ST. LOUIS, MO. 154

DIGESTIVE DISTURBANCES OF ARTIFICIALLY FED BABIES. IRVING M. SNOW, M.D., BUFFALO 163

INDEX TO CURRENT PEDIATRIC LITERATURE 178

American Journal of Diseases of Children

VOL. 8 NOVEMBER, 1914 No. 5

WEIGHTS AND MEASUREMENTS OF INFANTS AND CHILDREN IN PRIVATE PRACTICE COMPARED WITH INSTITUTION CHILDREN AND SCHOOLCHILDREN *

ROWLAND G. FREEMAN, M.D.
NEW YORK

Information as to the weights and measurements of children is only beginning to be reliable. Much that is erroneous has been published concerning the weights during the first year and very little data has been published as to the gain in weight and height of children under the good conditions that usually prevail in the feeding practice of pediatricians.

While believing that standard weight charts are an absolute disadvantage when given to the family, there can be no question but that a physician feeding a baby should have certain standards in mind, although each baby will supply a standard of its own.

While most of us have the care of a considerable number of children under very good conditions where the feeding can be, at least during the first years, absolutely controlled, where the exposure to fresh air, the amount of exercise, the amount of rest and the character of the clothing are all supervised, we have had little definite knowledge as to whether the results obtained for these children were commensurate with the care that was given them. We know in a general way that the mortality of these children is much less than that of children in general. For while the mortality in New York during the first year, which was, some years ago, 30 per cent., is now about 10 per cent., I believe the mortality for well-cared-for babies during that period to be not more than one-half of 1 per cent. Of this fact again we have no definite data, but of the 120 consecutive cases in private practice that I have tabulated, not one died during the first year.

There has been accumulated now a considerable number of weights and measurements of schoolchildren in the United States, while the only data that I know of the weights and measurements of children in

* Submitted for publication June 13, 1914.

* Read at the Twenty-Sixth Annual Meeting of the American Pediatric Society, at Stockbridge, Mass., May 27, 1914.

private practice are those published by W. Camerer.[1] It therefore seemed of interest to me to make an average weight chart of 278 cases in private practice, as well as a chart showing their measurements, and in order to get definite data for comparison I weighed and measured the 1,000 children, about 500 girls and 500 boys, in the Roman Catholic Orphan Asylums of New York. These institutions are now situated on a high bluff overlooking the Harlem River, with modern, sanitary buildings, well lighted and with ample grounds, so that while these children are institution children they are really under good conditions, and there was almost no sickness among them at the time I made these observations.

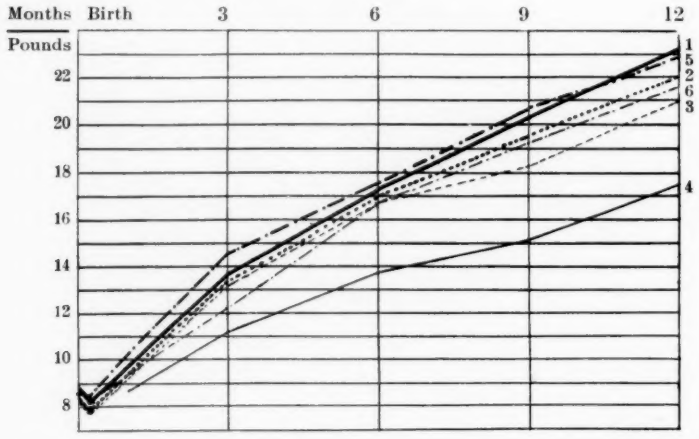

Chart 1.—Weight during the first year of 120 well-cared-for children ——— (1), compared with the average given by Dr. Holt ---------- (2 and 3) that of 500 institution children ———— (4); that given by Dr. Cammerer for 119 breast-fed children — - — - (5), and 84 artificially fed children — - — - — - — (6) in private practice.

I have prepared several charts in which I have compared the weights and measurements of the children in private practice, the orphan asylum children, and such data as I have obtained from other observations.

Chart 1 shows in the heavy black line the weights of 120 well-cared-for children, consecutive cases in my private practice, while the light line shows in contrast the average weight during the first year of 500 institution children.[2] It is noticed that these lines are well separated after the first month. The dotted lines which run well below the well-cared-for children, are taken from the different editions

1. Camerer, W.: Jahrb. f. Kinderh., 1901, lii, 381.
2. Fleischner, E. C.: Arch. Pediat., 1906, xxii, 740.

of Dr. Holt's book.[3] The lower line is the one used in the earlier edition (Second Edition, 1902) and "is made up from complete weight charts of 100 healthy nursing infants who were thriving and weighed every week, and the incomplete charts of about 300 other infants"; while the upper one is the one used in the last edition (Sixth Edition, 1911) and is made up from observations on the same number of children as the lower line. Both of these lines are seen to be below the well-cared-for children. The two dot and dash lines are the weights published by Camerer, the upper line representing breast-fed children and the lower line the artificially fed children. The breast-fed children show greater weight throughout the first nine months, while the artificially fed children keep fairly below. I may add that the 120 well-

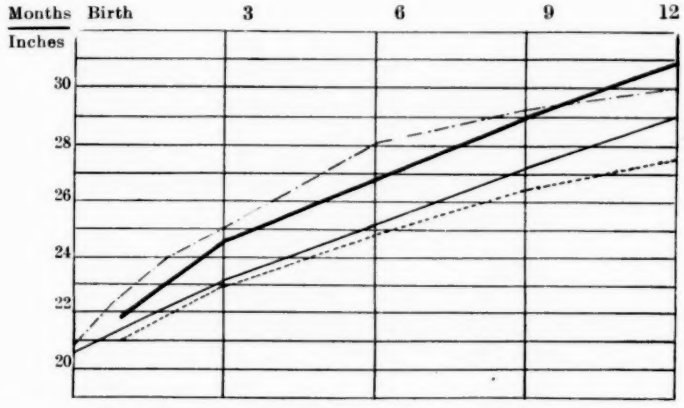

Chart 2.—Height during the first year of 120 well-cared-for children ——— compared with the average given by Dr. Holt ———, that of 500 institution children - - - - and that of 34 children given by Cammerer — — - - —.

cared-for children represented in the chart were almost entirely artificially fed after the first month, so that the American method of feeding children during the first year would seem to compare favorably with the method advocated in Germany.

Passing to Chart 2, we have in the heavy black line, again, the length of the same 120 well-cared-for babies that are represented in the other chart, while the lower, dotted line represents the measurements of the 500 institution children, and the light black line is the line taken from Dr. Holt's book, while the dot and dash line represents the measurements of thirty-four children reported by Camerer with no information as to whether they are breast fed or artificially fed. His line, however, corresponds to that of the breast-fed babies in the weight chart, being

3. Holt, L. E.: Diseases of Infancy and Childhood.

above my line at the first nine months and ending below it. It must, however, be considered that the thirty-four cases reported by Camerer are an insufficient number for the formation of conclusions, as there are only one to five observations on any given date.

The observations on children after the first year are represented in Charts 3 and 4.

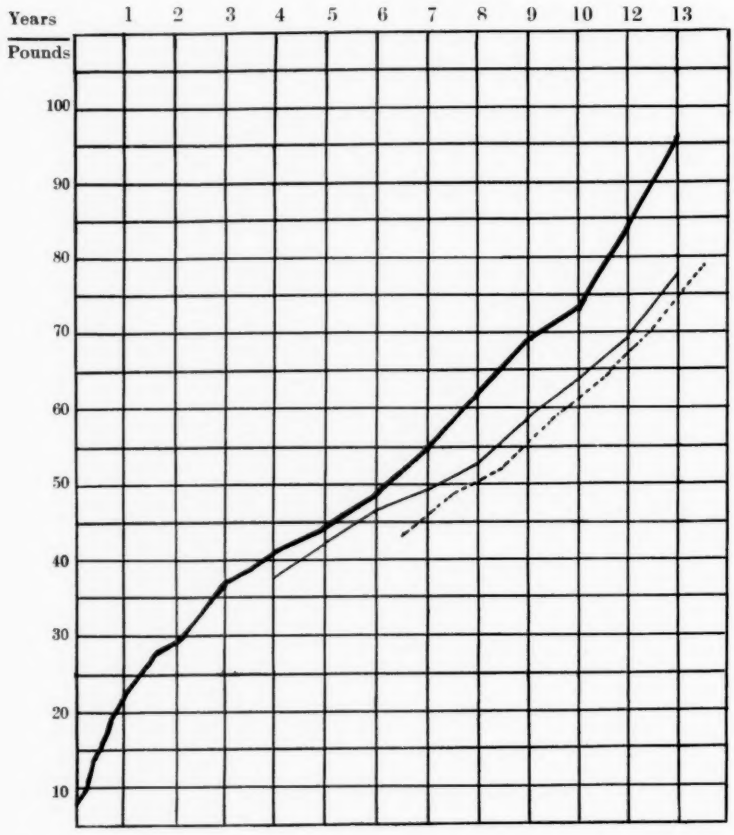

Chart 3.—Weight in pounds of 278 well-cared-for children ——— compared with 1,000 orphan asylum children ——— and 69,000 schoolchildren - - - - - -.

Chart 3 shows in the heavy black line the weight of 278 children in private practice as compared with the 1,000 orphan asylum children in the light black line, and with 69,000 schoolchildren in the dotted line, of various cities of the United States, as reported by Stanley Hall. It is noticeable that while from the fourth to the sixth year the orphan asylum children average two or three pounds less than mine, these lines

become farther apart with advancing age. It is an evidence of the excellent care given these orphan asylum children that they average 2 or 3 pounds heavier than the 69,000 schoolchildren. Both of these groups, however, from 6 years on, are well below the well-cared-for after several visits from a social worker, the child was not brought cared-for children.

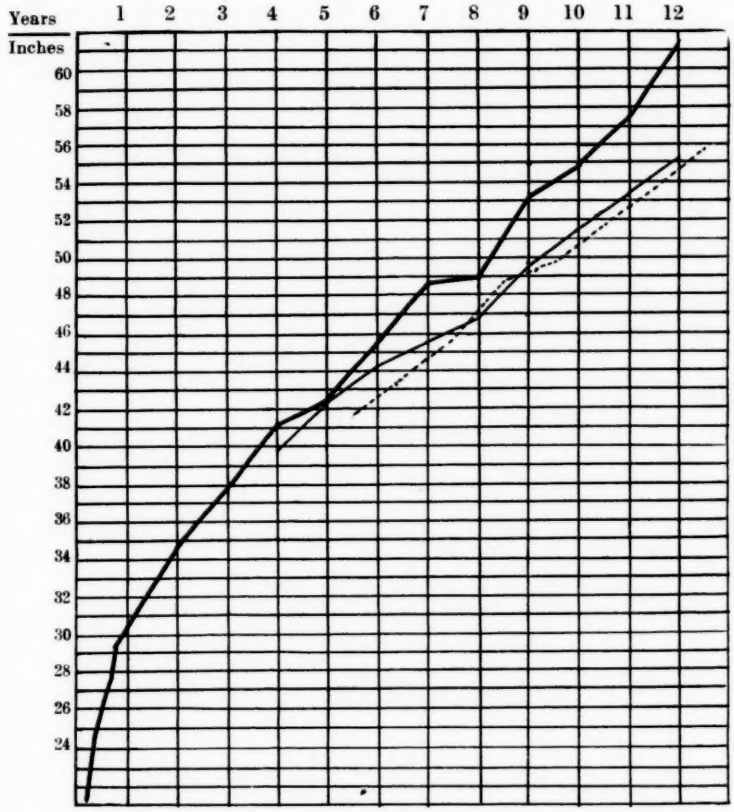

Chart 4.—Height in inches of 278 well-cared-for children ——— compared with 1,000 orphan asylum children ——— and 98,000 schoolchildren - - - - - -.

The last, Chart 4, which represents the length of the 278 well-cared-for children in the heavy line as compared with the 1,000 orphan asylum children in the light line, and 98,000 schoolchildren of the United States as reported by Stanley Hall, in the dotted line, shows the orphan asylum children again to average somewhat taller than the schoolchildren, both lines being well below the well-cared-for children. This shows a surprising advantage of the well-cared-for children over the others at the twelfth year, of 6 inches greater height.

In conclusion, I would say that the children that are under good control so far as diet, rest and exercise are concerned, show a great advantage over the data at hand concerning other children both in weight and height during the first twelve years of life; and that at the twelfth year they surpass the average by 20 pounds in weight and 6 inches in height.

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HEREDITARY SYPHILIS AS A SOCIAL PROBLEM *

P. C. JEANS, M.D., AND ELSA M. BUTLER, A.M.
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In a busy and overcrowded clinic, where only the most obvious and pressing needs can be seen at a glance, it is much easier to give the individual patient the immediate care which he needs than to grasp and classify the multifarious problems which the patients as a whole present. By watching and weighing these problems, in the course of time it became clear that the luetic children who were attending the various clinics in the St. Louis Children's Hospital presented a serious medical and social problem out of all proportion to their numbers in the clinics. It was noticed that many of the luetic children were brought to the clinic for a short period only. Some never returned after the initial visit. Others were brought until the immediate symptoms were cleared up and then were lost track of completely. This waste effort brought to the attention of the physicians the need of constructive work.

It is obvious that the medical side of the problem was untouched in the case of the patients needing care who did not return to the clinic. Therefore in the fall of 1913 the assistance of the Social Service Department was actively enlisted to bridge the hiatus between the dispensary and the homes.

In those cases in which the apparent manifestations had been cured, it was necessary to make a special point of explaining to the parents the property of this disease to become latent, and later to manifest itself in some disagreeable or even fatal form and prevail on them to continue the treatment. It was further necessary to examine the other members of the family represented and treat the affected children. It was also necessary to urge the treatment of the affected parents.

It seemed that no part of this program could be omitted if our work was to be efficient; and it was our opinion that the complete working out of the part of this community problem which presented itself to us was a part of the hospital's debt to the community.

When the children were being brought to the clinic regularly, the program outlined above was of course handled by the physicians alone, since the treatment is a purely medical problem. Three types of cases were, however, referred to the Social Service Department:

* Submitted for publication June 20, 1914.
* From the St. Louis Children's Hospital.

1. Children who were known to be luetic and whose parents, through ignorance or indifference failed to keep up the treatment or to report at the proper intervals.

2. Children who had clinical evidence of the presence of syphilis and therefore needed to have Wassermann tests made to verify the diagnosis, but failed to return for the Wassermann test.

3. Brothers and sisters of the patients whom the parents could not or would not bring for examination and for Wassermann tests.

1. The first group represents the greatest number of offenders. Because of the quick response to treatment in case of the acute manifestations of syphilis, the interest of the parents, which was at first perhaps intense, is apt to die out simultaneously with the disappearance of the acute symptoms. He will insist that the child is well, which to all outward appearances he may be; or he may state that returning for treatment involves too great an expenditure of time and trouble. Only when permanent damage has already been done, will he begin to realize his parental responsibility. It sometimes happens, even in an evidently uncured case, that the shock of initial revelation wears off, and the parent neglects to continue the treatment.

A good example of this state of affairs may be seen in the case of W. B. As an infant he had a rash which responded promptly to mercurial treatment, which was then stopped. At 6 years he developed an interstitial keratitis and was under the constant care of a physician for one year, when he recovered. Again treatment was discontinued. At 9 years he developed cerebrospinal manifestations, with epilepsy. This was allowed to go untreated, until he was brought to the Children's Hospital at 11 years of age. At this time he was brought for a burn and not for his other condition. He was treated for syphilis while in the hospital with considerable improvement. When his burn was well, he was discharged, to be treated in the dispensary. After discharge, the mother refused to bring him back, saying he was in the country, and, in her opinion, well. She also refused to cooperate by bringing in the other children for examination. A short time ago she returned with a younger child who showed evidence of syphilis of the nervous system. At this time the whole situation was again explained to her, and she promised to cooperate in every way possible, but at this writing she has not been back with any of the children, not even with the sick ones. Other cases equally flagrant might be cited.

After parents understood why treatment was necessary, the children were usually brought back. There were, however, some parents with whom indifference or the desire of shielding themselves outweighed the importance of treatment. It soon became clear that persuasion alone in these cases was not productive of results, so the sup-

port of the Juvenile Court was enlisted, on the ground that syphilitic children not under treatment, could be brought into court as "neglected children."

The court has taken the stand that the parents must give satisfactory evidence that the luetic child is being treated, but the parent has the option of returning to the original clinic where diagnosis was made, or going to another clinic, or securing the services of a private physician. Out of the whole series studied, only eleven were referred to court.

At no time were the parents threatened with court procedure. If, after several visits from a social worker, the child was not brought back, the Juvenile Court was notified. An officer of the court then went to the home and explained in a friendly way that unless the child was treated the parents would be brought into court. In every case but one such timely advice sufficed. The parents quickly saw that treatment would in any case be enforced, and that it was far easier to acquiesce than to have the nature of the child's malady publicly stated in court.

The results accomplished through court cooperation have been most interesting.

TYPES OF COURT CASES

1. M. G. was a girl of 6, who had come originally because she was suffering from spastic paralysis. In June, 1913, a Wassermann test was made, which proved positive. Many calls were made to induce Mrs. G. to bring M. to the clinic, but without success. Finally, through an order from the chief probation officer, M. was brought to the hospital by a social worker and treated for one week. At the end of that time, the mother insisted on removing M. from the hospital. She was forced to bring to court a written statement from a physician that he would treat M. and not discontinue treatment without reporting to court. This physician was anxious to assist in every way. He made several visits to the hospital to learn what treatment had been used. In the course of six weeks, this same physician returned with request that M. be treated in the clinic with neosalvarsan at his own expense.

As has been stated, when parents presented satisfactory evidence that child was under care of a private physician, no further steps were taken to follow up the case, since in the opinion of the Court a parent has the right to choose his own physician. But in cases in which the bare statement was made that child was being treated it was felt that the Juvenile Court should take the responsibility of placing the burden of proof on the parents.

2. An interesting example of this was a boy, E. F. E. F. came to the clinic in November, 1913, and a Wassermann test was made, which proved positive. E. F. came back five times quite regularly for treatment, and then stopped. Since E. did not return, a visit was made to the home, to learn the cause for his remaining away from the clinic. Mr. F. stated that he was prescribing for E. himself, giving him caffein and Scott's Emulsion, and refused to have E. treated by a physician.

Since persuasion was futile, the case was referred to the Juvenile Court. Mr. F. was required to bring a written statement to court from a doctor, stating that E was under his care.

3. V. R. was a colored child about 27 months of age and to all appearances perfectly well. In June, 1913, a positive Wassermann reaction was obtained. The mother was visited repeatedly from October until April, but always gave as an excuse for not returning that she disliked seeing so many sick children, and came away from the clinic greatly distressed. Although the mother was an ignorant, unmarried girl, she managed to thwart all procedure from June, 1913, until April, 1914, when she was forced by court to have V. treated.

As a test case in court, V. R. was considered peculiarly interesting, since she had no clinical manifestations of syphilis. That a judge was able to grasp the importance of the problem and willing to take such an advanced stand, speaks well for the general future effectiveness of the Juvenile Court.

2. In the second group of cases — in which a clinical diagnosis of syphilis is made, but the patient fails to return for a Wassermann — we have relied almost altogether on persuasion, since it has happened in many of these cases that the clinical evidence alone without the Wassermann test did not seem sufficient proof to refer to the Court.

3. In the third group — the examination of the other children of the family — there has been a fairly ready response on the part of many of the parents. In this regard a further step in court cooperation has just been secured. Hereafter in any family in which a child is found to have an hereditary syphilitic infection, if necessary, court authority will be used to force the parents to have the rest of the children examined.

In the case of the parents our difficulties are at present apparently insurmountable. There have been a few who have gone willingly on our advice to some physician or clinic for treatment. For the remainder we can do nothing but explain and persuade. We can only let them continue their possible additions to mortality in real and potential life or to the asylum population of the community.

We realize that the enforced examination and treatment of patients is condemned by some, and that this broader view of the problem might be considered as outside the province of a hospital clinic, but in our opinion it is a legitimate work and duty which the hospital owes to the community. The Children's Hospital has been established in part to recognize community problems and in so far as possible to be an intelligent leader in directing their solution. Since the hospital was touching the social problem represented by syphilis it was felt that in order to get a real knowledge of the magnitude and character of the problem in St. Louis, an intensive study should be made wherever possible of the conditions to be found in the community at large. Therefore some of the social aspects of a group of cases of hereditary

syphilis at the St. Louis Children's Hospital together with data obtained elsewhere in St. Louis seem of sufficient interest to be presented.

ILLEGITIMACY

In studying the relation of hereditary syphilis to illegitimacy, very few definite data can be obtained. The only comparisons we have been able to make have been based on the infant death statistics of St. Louis for 1913 (Table 1).

TABLE 1.—STUDY OF CONGENITAL SYPHILIS IN ITS RELATION TO ILLEGITIMACY

Of all deaths in infants in St. Louis in 1913.....10 per cent. were illegitimate
Of all deaths in infants due to syphilis.....15 per cent. were illegitimate
Of the deaths in our Group 1.....22 per cent. were illegitimate
(Group 1 consists of all luetic infants belonging to the Children's Hospital series).

This shows that the mortality is much higher among syphilitic illegitimate infants than among illegitimate infants in general (Table 2).

TABLE 2.—DEATHS DUE TO SYPHILIS (ST. LOUIS, 1913)

	Percentage		
Type of birth	Total	Legitimate	Illegitimate
Living	3.5	3.0	5.1
Still	2.9	2.7	5.0

Among both living births and still-births syphilis was present in a larger proportion of the illegitimate than the legitimate children.

COLOR

That there is a difference in the morals and the standards of living between the negroes and the whites is well known. And since syphilis is a disease which is engendered and spread by low standards of living and morals, it has been interesting to see whether in the groups studied the frequency of the disease has any relation to color.

We find that syphilis is diagnosed in 2.5 per cent. of our clinic patients. It occurs 2.5 times more frequently in the colored than the white patients, 2.2 per cent. of the whites being syphilitic and 5.5 per cent. of the colored. White patients represented 92 per cent. of our clinic attendance, but only 83 per cent. of our syphilitics. Colored patients represented 8 per cent. of our attendance and 17 per cent. of our syphilitics.

In studying the St. Louis vital statistics for 1913, we find syphilis given as a cause for still-births twice as frequently in colored as in whites, while for infants who were born alive, but who later died, syphilis is given as a cause of death 3.5 times as often in colored as in whites.

INCIDENCE AND MORTALITY

During 1913 in the out-patient department of the Children's Hospital a total of 5,185 new patients were treated. Of these, 108, or 2 per cent. had congenital syphilis. But by separating these 5,185 into two groups — (1) children under 13 months; (2) children 13 months of age and over — we find a wide difference in the proportion of syphilitic children in these two groups, as is shown by Table 3.

TABLE 3.—COMPARISON OF CHILDREN UNDER AND OVER 13 MONTHS WITH RESPECT TO SYPHILIS

Group	Total	Syphilitic	Per Cent. Syphilitic
1	854	42	4.9
2	4,331	66	1.5

The difference in the two groups is probably due to two facts — (1) a large number of infants infected with syphilis die; (2) as a child grows older the more acute symptoms are not so likely to be manifest, so that many cases of latent syphilis pass by unnoticed.

In discussing hereditary syphilis, incidence and mortality are so closely interwoven that it seems appropriate next to show the high proportion of deaths among children of luetic parents. For a basis of comparison, a study has been made of the families represented by the syphilitic children, one hundred families represented by children treated in the hospital for contagious disease, and one hundred families represented by children taken at random from the hospital records. The syphilitic families for whom we have data number eighty-three. For convenience, these groups will be called S, C and R, respectively (Table 4).

TABLE 4.—MORTALITY AMONG THE VARIOUS GROUPS

Group	Total Children Born	Total Children Dead	Per Cent. Dead
S	270	66	30
C	398	70	17
R	400	59	15

In other words, the mortality among the children in the syphilitic group was practically twice as great as that of either of the others. Now 15 per cent. and 17 per cent. represent what is at present to be found in the average poor family. What explanation can be found for the 30 per cent. in the syphilitic group except the damage caused by syphilis, since the families studied came from the same stratum of life, made up of people of the same standards of living, the same intelligence and training, the same income and living in the same neighborhoods?

Turning now to a broader field we may consider syphilis in its bearing on infant mortality as revealed by the St. Louis vital statistics

of 1913. During 1913 there were 14,958 births recorded. Of this number, 711, or nearly 5 per cent., were still-births. Twenty-one still-births, or 2.9 per cent. of all stillbirths, were due to congenital syphilis. That this figure must greatly underestimate actual conditions can be seen by examining the records of the Obstetrical Department of the Washington University Hospital. From Jan. 1, 1913, to Jan. 1, 1914, 565 women were cared for during parturition. There were 40 still-births, of which 16, or 40 per cent., were known to have been caused by syphilis, since an autopsy had been made in each case. A few others were probably syphilitic, but the diagnosis was not confirmed by autopsy.

TABLE 5.—COMPARATIVE STUDY IN DESTRUCTION IN LIFE DUE TO SYPHILIS

Families Represented by	Total Pregnancies	Miscarriages	Premature Births	Still Births	Dead Among Living Births	Total Waste	Per Cent. Waste
100 R	442	31	6	5	59	101	25
100 C	444	39	2	5	70	116	26
83 S	453	84	10	22	104	220	46

(Figures for "S" calculated to 100 families.)

In the city of St. Louis there were 14,247 living births recorded in 1913, and 1,469 deaths occurred in this group. Fifty-two of these deaths, or 3.5 per cent., were recorded as due in whole or in part to hereditary syphilis. The error in this figure is probably not so great as in the stillbirths, but here also one feels that the figure is low, partly because of a general dislike of stating syphilis as a cause of death. Especially is this true with private physicians as compared to physicians in public institutions. This may be indicated by the fact that, though only 25 per cent. of all deaths in 1913 in infants occurred in hospitals, 50 per cent. of all diagnoses of congenital syphilis as a cause of death were given for babies who died in hospitals.

In studying the family conditions revealed by the birth and death certificates we find that in the families represented by infants which were born alive, but which later died of syphilis, 59 per cent. of all the children born in these families are now dead. In the families represented by the stillbirths due to syphilis 81 per cent. of all the children born are now dead.

Since damage wrought by syphilis must not be confined to study of living children alone, we compared the three groups of cases C, R and S, enumerated above to see just how important and destructive a factor syphilis has been in the total waste of human life.

Thus it is seen that the waste of life is almost twice as great among children of syphilitic families as among similar families that are not syphilitic.

In further study of the damage caused by hereditary syphilis we wish to call attention to the high mortality in our Group 1 and the high morbidity in Group 2.

Among the children under 13 months in the group still under study, eleven, or 22 per cent., have already died before reaching the age of 1 year. That more in this group will die at an early date seems at present apparent. The general mortality rate for infants in St. Louis is about 10.3 per cent.

Of the 74 children in Group 2, twenty-five show permanent and fourteen show long-continued temporary damage. These figures include only the disabling manifestations. The cases of permanent defect were all affections of the nervous system, and the cases of long-continued temporary damage all affections of the eye. Some of these eye affections have been faithfully under treatment for nearly two years, and though greatly improved, the vision is still impaired.

It is of interest in this connection to compare the amount of feeble-mindedness in the three groups R, C and S (Table 6).

TABLE 6.—PREVALENCE OF FEEBLE-MINDEDNESS

Group	No. of Families	Families with Defectives	Per Cent.
S	83	17	20
C	100	4	4
R	100	3	3

It would seem that there is five times as much feeble-mindedness in the syphilitic group as in the non-syphilitic families. It is easily possible, however, that there is a fallacy in this compilation, in that mothers in giving their family history will not always disclose the fact that they have defective children.

VALUE OF MATERNAL NURSING

The fact that breast feeding is the greatest preventive force in curtailing infant mortality is well known. Yet it is important to state such a well established fact, since the nature of the feeding plays an even more important part in the chance for life among syphilitic than among non-syphilitic infants.

During the time that the intensive study of syphilis has been carried on, forty-nine infants have been treated. Eleven of these have died, representing a mortality of 22 per cent. Of the eleven infants who have died, ten, or 88 per cent., were artificially fed.

Of the 49 infants in Group 1, the character of feeding is known in case of 30; of these, 19 were artificially fed, and 11 were breast fed. Of the 19 artificially fed babies, 10 have already died. Of the 11

breast-fed babies one has died. None of these deaths was due to summer or diarrheal disturbance, but largely due to malnutrition as a result of syphilitic infection.

In the older group of children there were 27, the character of whose feeding in infancy is known. Of these, 4, or 15 per cent., were artificially fed. In order to get some estimate of the relative amount of breast and artificial feeding in general in the class of patients represented by the group under study, the hospital records of older children show that about 28 per cent. had been artificially fed in infancy. Though perhaps no definite conclusion can be drawn from this, it is very significant that with probably the same prevalence of artificial feeding in infancy almost twice as many of the non-syphilitic children survived on artificial feeding as did syphilitic children.

SUMMARY

As a social problem, hereditary syphilis assumes relatively large proportions, one patient often representing a number of individuals needing treatment.

Parents are frequently indifferent and fail to continue treatment. They also frequently fail to see the importance of having Wassermann tests made on the other children of the family, who may seem perfectly well, but who may have syphilis. In the case of such parental indifference such tests or treatment should be enforced.

Hereditary syphilis is more frequent in illegitimate than legitimate children.

The mortality is higher in illegitimate syphilitic infants than legitimate syphilitic infants.

Hereditary syphilis in St. Louis is from two three times as frequent in the colored as in the white race.

The frequency of hereditary syphilis is greater among the infants in our clinic than among the older children.

The waste in potential life by miscarriages and deaths in syphilitic families is twice as great as in non-syphilitic children.

Thirty-three per cent. of the syphilitic children over one year had permanent disabling damage. Eighteen per cent. of the syphilitic children over one year had long-continued temporary disabling damage.

There is about five times as much feeble-mindedness in syphilitic families as in non-syphilitic families.

The mortality for artificially fed syphilitic infants is five times as high as for breast-fed syphilitic infants, not including deaths due to intestinal disturbances.

We are indebted to the College Club of St. Louis for access to their work on the St. Louis vital statistics.

St. Louis Children's Hospital.

SPLENOHEPATOMEGALY GAUCHER

MARK S. REUBEN, M.D.
NEW YORK

I have already[1] reported a case of splenomegaly Gaucher in a child 4 years old. In March, 1912, splenectomy was performed on this patient. The child did not survive the operation. Histologic study of the liver, the spleen, the lymph glands and the bone-marrow confirmed the diagnosis previously made on a clinical basis. This is the first case to be reported in the English language in which the diagnosis in a child was made prior to operation or to necropsy, and was confirmed later. The diagnosis was correctly made in a child only once before, by De Jong and Van Heukelom in 1909.

In the previous paper a study of this disease was presented as it occurs both in adults and in children. In this paper only the cases which occurred in infants and children will be discussed. Although the clinical picture is almost identical with that which occurs in adults, the course of the disease and the indications for treatment are so different that it seems best not to include in this study, the cases reported in adults. Since the publication of the previous article, three other cases of this disease in children were reported; in all of these the diagnosis was made after splenectomy.

REPORT OF CASES

Family History.—Father and mother both living and well; there is no tuberculosis in the family; nor could any luetic history be obtained. The mother has given birth to four children, and has had no miscarriages nor stillbirths. Anna, the oldest child, is 11 years old. Lilly died in 1909 at the age of 8; Freda is 9 years old, and Max, the youngest, is 4 years old. Wassermann reaction of mother negative.

The boy came to my notice at the Vanderbilt Clinic June 10, 1911, where he was brought for treatment on account of a progressive enlargement of his abdomen. The mother stated that an older child (Lilly) had had a similar condition and that that child died two years previously; as this child (Lilly) had been at Mt. Sinai Hospital (1906) at a time when I was a member of the house staff of this hospital, I can recall the case very clearly. At the hospital no diagnosis was made. This child was also treated at the Vanderbilt Clinic in 1904, and notes of the case show that at that time the child had a much enlarged spleen and liver. No diagnosis was made at the time.

Case 1.—Anna: Physical examination of this child revealed nothing abnormal; she was in good physical condition, the liver and spleen were not enlarged.

Case 2.—Lilly: This child died two years previously at the age of 8; she had measles at 2 years; no other diseases of infancy; no history of malaria. At 4

1. Reuben, Mark S.: Splenomegaly (Gaucher), Am. Jour. Child. Dis., January, 1912, p. 28.

years the child began to be troubled with enlargement of the abdomen; also complained of dragging sensation in the side and weakness. The abdomen was progressively increasing in size; at the time the child was at the hospital the liver was 10 cm. below the free border of the ribs, and the spleen was beyond the median line and well filled the left iliac cavity. The child had at no time any hemorrhages nor oozing from the gums, and there was no discoloration of the face.

The blood examination showed the following:

Red blood-cells, 3,440,000; white blood-cells, 6,200; hemoglobin, 68 per cent.; differential count, normal; no abnormal cells present.

Mixed treatment, arsenic and Roentgen ray were ineffectual and the child was discharged from the hospital unimproved. A few months later the child suddenly developed dyspnea and cyanosis and succumbed before a physician could be called.

CASE 3.—Freda: The third child was 9 years old; she had no diseases of infancy, and there was no history of malarial infection. During the last year she complained of pain in the abdomen. Physical examination showed the liver to be enlarged; the edge was palpable 2 inches below the free border of the ribs. The spleen was not enlarged and the edge was not palpable. The blood examination showed the following: Red blood-cells, 4,344,000; white blood-cells, 7,000; hemoglobin, 75 per cent.; differential count, normal; no abnormal cells present.

There was no pigmentation of the skin, and no history of any hemorrhages nor oozing from the gums or lips; there was no bone tenderness and the lymph-glands were not enlarged. Whether Freda was suffering from the same disease as Lilly and Max (the latter case to be described later) only the future will reveal, but she had a much enlarged liver, which cannot be attributed to any other cause; whether she will develop a large spleen later cannot be definitely stated.

CASE 4.—Max: The fourth child was a boy 4 years old; he had no diseases of infancy; he was not rachitic, and there was no history of malarial infection. About one year previously he was thrown down by a horse; at this time the attending physician told the mother that the child had a large liver and spleen; since that time the mother noted a progressive enlargement of the abdomen and brought the child to the clinic on that account. Examination of this child showed there was a distinct discoloration of the face; the color varied from light yellow to golden hue. The pigmentation was most marked at the bridge of the nose and around the eyes. There was no discoloration of the conjunctivae. There was a general languid appearance, and the child moved about very slowly; the child did not complain of any pain nor was any tenderness to be elicited in the chest or abdomen. Heart and lungs were normal. The liver was much enlarged and the edge was palpable at the umbilicus; there was no tenderness over the liver. The spleen reached to 2 inches below the umbilicus and extended over the median line to the right as far as the mammary line.

The blood examination showed the following: Red blood-cells, 2,208,000; white blood-cells, 5,000; hemoglobin, 35 per cent.; differential count, normal; no abnormal cells found. There was no history of hemorrhages; no bone tenderness, and the lymph-glands were not enlarged. Wassermann reaction negative.

Iron and arsenic were administered and other hygienic measures were instituted; under the treatment the child's condition and the blood-picture improved; but in spite of the general improvement, the spleen and the liver continued to enlarge; in view of the fatal termination of this disease in a sister of this patient, splenectomy was advised, and the child was referred to Mount Sinai Hospital for operation.

The blood examination at time of admission to the hospital was: red blood-cells, 4,000,000; leukocytes, 4,200; hemoglobin, 68 per cent.; color-index, 0.85;

differential count: polynuclears, 70 per cent.; large lymphocytes, 25 per cent.; small lymphocytes, 3 per cent.; mononuclears, 1 per cent.; myelocytes, 1 per cent.; no normoblasts; slight poikilocytosis and anisocytosis.

Splenectomy was performed by Dr. Joseph Wiener on March 1, 1912; the spleen extended downward to the floor of the pelvis. The entire operation lasted less than one-half hour. The condition immediately after operation was good. The blood examination after operation was: red blood-cells, 3,860,000; leukocytes, 19,600; hemoglobin, 66 per cent.; differential count—polynuclears, 72 per cent.; large lymphocytes, 20 per cent.; small lymphocytes, 8 per cent.

Within a few hours the temperature rose to 104 F., and the child died the following day.

The spleen immediately after operation weighed 490 gm. and measured 18 by 9.5 by 5 cm. The general configuration was quite normal, though the organ was slightly elongated. The surface was smooth; the color a peculiar brownish-salmon; on section, the surface was mottled, due to the presence of transparent pearly areas, mixed with minute hemorrhagic spots. There were no tubercles present, no large nodules nor areas of necrosis, the entire surface presenting a mottled homogeneous appearance.

The necropsy was performed in my presence by Dr. Thalheimer. The heart, lungs, larynx, trachea and bronchi were normal; the tracheobronchial nodes were enlarged; thymus and thyroid were normal; there was no free fluid in the abdomen; no oozing from the stump. The liver weighed 730 gm.; the size was 20 by 13 by 6.5 cm. It extended 6 cm. below the free border of the ribs. The surface was smooth and glistening and the color was light pinkish-yellow, the capsule was not thickened; on section the same color was seen. The lobules were but poorly outlined and some diffuse gray areas were noted. A few white irregularly shaped areas were present, varying in size from 2 mm. to 1 by 1.5 cm. in diameter. They were situated around the medium-sized blood-vessels and slightly raised above the surface. Their borders were not well defined and the outlines of the lobules could barely be determined in them. At the hilus were about twelve enlarged lymph-nodes from 1 to 2 cm. in diameter; these were very friable, semitranslucent and of light brownish-gray color; on section the same color was seen and they were quite succulent in character.

The kidneys, adrenals, esophagus, stomach and intestines were normal. The abdominal lymph-nodes were enormously enlarged, many of these being from 1 to 2 cm. in diameter. The pancreas was normal; the bone-marrow was of bright red color, with small white dots.

The microscopic examination of the organs was carried out by Mandelbaum[2] and I am indebted to him for the opportunity of studying many of the slides with him.

Smears were made from a freshly cut surface of the spleen shortly after its removal. The cells presented the general appearance described by all previous observers; study of sections of the spleen with low power revealed many large round or oval spaces, with well-defined outlines; these were the venous sinuses. The sections also contain a large number of similar alveolar spaces, filled with large cells; the large cells are identical with those found in all the previous cases; isolated groups of large cells were seen between the lymphoid cells of the follicles, often near the peripheral part. Throughout the sections were mononuclear cells, with eosinophil granulations; within the lumen of the venous sinuses, no reticulum fibers were seen; there were no areas of degeneration, necrosis or hemorrhage in the spleen, and no evidences of a tuberculous process (see illustration).

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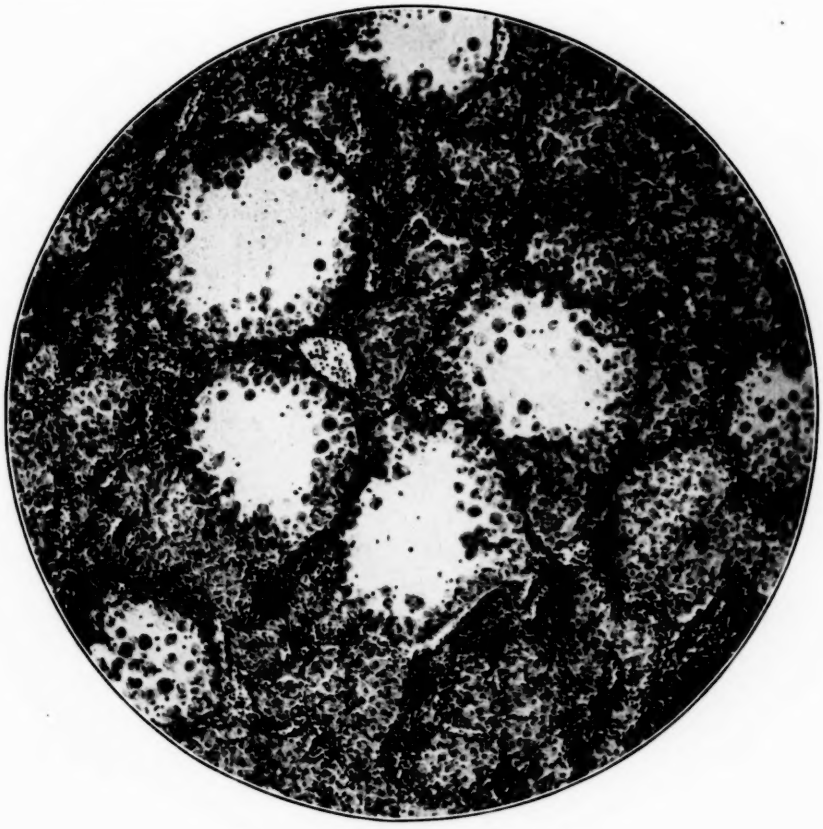
2. Mandelbaum: Jour. Exper. Med., 1912, xvi, 6.

The degree of involvement of the lymph-nodes varied considerably in the different groups of nodes, but the type of lesion corresponded with that described in other cases; the retroperitoneal and the mesenteric nodes showed the greatest involvement; the pigment in these nodes is quite abundant; it is never free but is always situated in cells of various sizes.

The large endothelial cells were very numerous in the bone-marrow. Sections from some portions of the liver were quite normal, while other parts showed the characteristic lesion.



Splenomegaly Gaucher type; × 80

Mandelbaum summarizes the pathologic findings in this case as follows: "The lesions are found in the spleen, lymph-nodes, bone-marrow and liver. These organs show the presence of iron-containing pigment, and large multinuclear cells with a characteristic cytoplasm. In the early cases peculiar large phagocytic cells arising from atypical large lymphocytes are found in the follicles (*Keimcentra*) of the hemopoietic system. After leaving the follicles these cells possess phagocytic qualities for a certain period. As a result of the phagocytosis the cells enlarge, the nature of the cytoplasm changes, and the cells acquire a characteristic vacuolated and wrinkled appearance. The cells are carried from the spleen through the portal system to the liver, where they are destroyed. The irritation produced by this destructive process gives rise to an increase in the intralobular connective tissue."

EPITOME OF ALL THE CASES OF SPLENOMEGALY GAUCHER (IN CHILDREN) REPORTED IN THE LITERATURE

COLLIER'S CASE 1.[3]—The spleen was taken from the body of a female child aged 6 years, who was admitted to Radcliffe Infirmary April 4, 1894, and died there Sept. 7, 1894. The mother stated that the child was healthy up to 8 months, when she had a severe illness the nature of which is not known. When

FINDINGS IN THE CASES—

	Case No.	Sex	Age	First Splenic Enlargement Noted at Age of	Spleen Enlarged	Liver Enlarged	Hemoglobin	Red Blood-Cells	White Blood-Cells
Collier	1	♀	6	2	+	+	†	†	†
	2	♀	10	?	+	+	?	?	?
Bovaird	3	♀	6	3	+	+	60	2,880,000	4,000
	4	♀	13	3	+	+	75	4,440,000	9,000
	5	♀	12½	7½	+	—	65	4,782,000	3,800
De Jong and Van Heukelom	6	♀	18	8	+	+	90	4,136,000	3,100
	7	♂	15	?	+	+	70	3,908,000	3,700
Reuben	8	♀	8	4	+	+	68	3,440,000	6,200
	9	♂	4	4	+	+	35	2,208,000	5,000
Niemann	10	♀	17 *	2 *	+	+	‡	‡	‡
Erdmann and Moorhead	11	♂	8½	1¼	+	+	62	3,912,000	4,600
	12	♀	3½	1¼	+	+	56	5,000,000	9,800
Bernstein	13	♀	7	6	+	+	?	?	?
	14	♂	14½	6½	+	+	30	2,560,000	2,400

♂—Denotes male. ♀—Denotes female. * Months. † R. B. C. misshapen; no excess

† Since my article was submitted for publication, Dr. J. H. Mason Knox, Jr., and Dr. (abstr. *Arch. Pediat.*, June, 1914, p. 467). The patient was 11 months old, had never lymph glands and a peculiar yellowish pigmentation of the skin of the exposed parts. ance characteristic of lymphatic leukemia. The picture in the spleen resembled that first and until the full report of the case is published it is best not to include it among the

2 years old the abdomen was noticed to be enlarged, and was steadily increasing in size. The blood was examined, but no excess of white blood-corpuscles was found. The red blood-corpuscles were misshapen and did not form good

3. Collier: A Case of Enlarged Spleen in a Child Aged 6, Tr. London Path. Soc., 1895.

rouleaux. Slight bending of ribs, but no other signs of rickets, was present. Death seemed to be accelerated by an attack of "epistaxis and sickness." The mother stated that she had seven children, four of whom died previously to this one—one of inflammation of the lungs, two of consumption of the bowel and one in the infirmary six years previously.

Necropsy showed no tuberculosis; spleen weighed 4 pounds 2 ounces; child 23 pounds; all mesenteric glands enlarged.

—IN THE LITERATURE †

Pigmentation	Location of Pigmentation	Hemorrhages	Splenectomy	Necropsy	Survived Splenectomy	Cause of Death	Wt. of Spleen, gm.	Weight of Liver, gm.
?	?	Epistaxis	..	+	..	Disease	2,070	
?	?	?	..	+	..	Disease	875	
Bronzed	Face, nose, hands	Epistaxis						
Bronzed	Face, nose	?	+	+	..	Splenectomy	6,200	2,380
Yellow brown	Abdomen	Oozing gums	+	..	+	.....	1,850	
Brown	Abdomen	Menorrhagia						
No pigmentation	..	Epistaxis						
Roman gold	Face	?						
Roman gold	Face, Hands	Epistaxis	+	+	..	Splenectomy	490	730
Pale brown	Face	?	..	+				
Looked dark	?	Epistaxis	..	..	..	Disease		
?	?	?	+	..	+	.....	430	
?	?	?						
Dark brown	Face	Epistaxis hematemesis	+	..	+		1,320	

of W. B. C. ‡ Normal in every respect.
R. H. Wahl reported a case of this disease (?) before the American Pediatric Society thrived and weighed 11 pounds. There was idiopathic enlargement of the spleen, liver, The blood-picture was normal until a few days before death, when it assumed the appear- described by Gaucher in 1882. From the abstract quoted it is hard to classify this case authentic cases.

COLLIER'S CASE 2.—The sister died at an infirmary Nov. 27, 1888; was admitted with bronchitis and enlarged spleen; gradually lost strength and died of exhaustion. No tuberculosis was found on necropsy. The spleen was found to be enormously and uniformly enlarged; weight 25 ounces. On section it was found congested and its substance was firm though somewhat friable. (Reported Jan. 16, 1895.)

Bovaird's Case 1.[4]—Female, aged 3; father and mother living and well; nine children; one stillbirth at eight months; four died during infancy from summer complaint; five are living; no previous diseases.

For about one year the mother noted enlargement of abdomen, steadily increasing; also noted a mass on right side of abdomen as well as on left; was sent to hospital; the child was of normal stature, well nourished, not anemic; skin dusky; some signs in the lungs; liver dulness from fourth space to 3 inches below free edge of ribs; edge was hard and sharp; spleen extended to within ½ inch of median line at umbilicus; lower end on a level with anterior superior spines of ilium; edge sharp and hard; nodes in each axilla; one node the size of a bean; both sets of inguinal glands were slightly enlarged, not tender, freely movable. Blood, 4,400,000 reds, 9,000 whites, hemoglobin 75 per cent.

The child was in the hospital from Nov. 28, 1896, to Dec. 22, 1896; seemed quite well; chest signs cleared up; gained 1¾ pounds. Treatment, Fowler's solution.

Some time prior to July 26, 1899, the child had been failing; nose bled frequently and quite severely; lost flesh; face and hands had become bronzed. At this time—age 6 years—across the bridge of the nose and on the cheeks and hands there was diffuse bronzing of the skin; abdomen spare, prominent; superficial veins enlarged; liver extended from sixth rib to within 1½ inches of umbilical line. The spleen later extended into and filled the right iliac fossa. The glands, inguinal, cervical and axillary, were slightly enlarged. Blood, 4,180,000 reds, 14,000 whites, hemoglobin 62 per cent. In December, 1899, the child had not improved but was able to attend school.

Bovaird's Case 2.—Female, sister of above patient, aged 13, had measles at 5 years; at 7 an eruption on the scalp. At the age of 3 the mother noticed an enlargement of the abdomen which progressively increased in size, and also pigmentation of the skin, especially across the nose. The child complained of a little discomfort from the enlarged abdomen and was a little short of breath. When admitted to the hospital she was small in stature for her years, fairly well nourished, skin dusky; across the nose, underneath the eyes and on the upper lip there was a decided brownish pigment. Liver dulness extended from the fifth space to the margin of the ribs; edge could not be felt; superficial veins were dilated. The spleen extended to 1 inch above the umbilicus, passed obliquely to the anterior superior spines and was hard and smooth. There was slight enlargement of right inguinal nodes, moderate enlargement of both submaxillary and one palpable node in each axilla; no enlargement of the epitrochlear nodes. Blood, 2,880,000, reds, 4,000 whites, hemoglobin 60 per cent. Mixed treatment was tried without effect. Three years later the condition was the same; the child did not grow in stature or gain weight. Readmitted to the hospital in 1899, aged 16 years. The patient was fairly well nourished, face and hands deeply bronzed; liver dulness began at the sixth rib; edge 1½ inches below the free costal margin; the spleen filled the whole of the left iliac fossa. Blood, 3,550,000 reds, 7,000 whites, hemoglobin not stated. Splenectomy was performed May 17, 1899, by Dr. A. J. McCosh. The patient died three hours after operation. The spleen weighed 12½ pounds.

De Josselin de Jong and van Heukelom's Cases.[5]—Father, a Jewish merchant 54 years old, has tabes; mother 50 years old and is healthy. The oldest of eleven children is 28 years old, the youngest 10 years old. Only six of

4. Bovaird: Primary Splenomegaly—Endothelial Hyperplasia of the Spleen—Two Cases in Children; Autopsy and Morphological Examination in One, Am. Jour. Med. Sc., 1900.

5. De Josselin de Jong, R., and van Heukelom, J. Siegenbeck: Beitrage zur Kenntnis der grosszelligen Splenomegalie (Typus Gaucher), Beitr. z. path. Anat. (Zeigler), 1910, xlviii, 598.

these could be examined; of these three had enlarged spleens and livers (the seventh, eighth and tenth were affected); no children died and there were two miscarriages.

CASE 1.—Betsy, 12½ years old; first observed at age of 5½ years; at 7½ years was brought to hospital for enlargement of abdomen. The child complained of weight in lower abdomen; was easily tired and complained of pain in left side; splenic and hepatic enlargement was noted at this time. At 10 years abdomen is still larger; child complains of morning nausea and occasionally vomits. In the last few years oozing from gums has occurred. Child never had any fever; only had measles previously. Skin of face is white and pale; the cheeks red; the skin of the body, especially the abdomen is of a light yellow brownish hue; veins of abdomen dilated; blue spots (mongol spots) on abdomen and back. Lymph-glands are not enlarged; no bone tenderness, no ascites; the liver two finger-breadths below the free border of the ribs; the spleen reaches to symphysis and is very hard; no urobilinuria. Blood examination: hemoglobin, 65 per cent.; red blood-cells, 4,782,000; white blood-cells, 3,800 (from 2,200 to 3,800); polynuclears, 51 per cent.; mononuclears, 46.5 per cent.; eosinophils, 2 per cent.; basophils, 0.5 per cent.; 1 myelocyte and 1 normoblast; von Pirquet negative; Wassermann negative. On Roentgen-ray and arsenic treatment the patient became worse and the hemoglobin came down to 55 per cent. The diagnosis of splenomegaly Gaucher was made, and the child was referred to Dr. Van Rossen for splenectomy. One day after operation the hemoglobin was 65 per cent.; red blood-cells, 4,960,000; white blood-cells, 15,500; the general condition became much better; the oozing from the gums stopped; the tiredness and nausea disappeared. Six months later the child's condition was excellent; the liver, however, had grown larger and was now palpable four finger-breadths below the free border of the ribs. The blood examination at this time showed: hemoglobin from 80 to 85 per cent.; red blood-cells, 4,920,000; white blood-cells, 14,400; polymorphonuclears, 54 per cent.; eosinophils, 10 per cent.; small lymphocytes, 18.6 per cent.; large lymphocytes, 10.6 per cent.; transitionals, 6.8 per cent.

CASE 2.—Sara T., aged 19, first observed at age of 13 years, at which time a hepatic and splenic enlargement was found. Blood: hemoglobin, 79 per cent.; red blood-cells, 3,500,000; white blood-cells, 4,350. First enlargement of abdomen noted by mother when child was 8 years old. At 17 child complained of pain in side and had a feeling of weight; at times complained of nausea; no oozing from gums; no epistaxis. Skin is white with the exception of a few yellow brownish stains on abdomen; no enlarged veins of abdomen; no ascites; no bone tenderness. The liver is hard and is especially enlarged in the horizontal direction; the spleen is hard and passes the median line. The hemoglobin is 90 per cent.; red blood-cells, 4,136,000; white blood-cells, 3,100.

CASE 3.—Brama de J., 15-year-old boy; never complained of anything. On examination spleen and liver were found to be enlarged. Boy had frequent epistaxis; no oozing from the gums; skin of normal color; glands normal; abdomen enlarged. The liver is three finger-breadths below free borders of ribs; the spleen is enlarged to the navel; no ascites. Blood examination: hemoglobin, 70 per cent.; red blood-cells, 3,968,000; white blood-cells, 3,700; polynuclears, 64 per cent.; eosinophils, 3.3 per cent.; small lymphocytes, 19 per cent.; large lymphocytes, 7.3 per cent.; transitionals, 6.3 per cent.; von Pirquet negative.

NIEMANN'S CASE.[6]—Irene D., 17 months old; sick since age of 2 months at which time the spleen was enlarged; from birth was a difficult feeding case. The emaciation was progressive; the abdomen was progressively growing

6. Niemann, Albert: Ein unbekanntes Krankheitsbild, Jahrb. f. Kinder., January, 1914.

larger. At time of admission to the hospital, the infant was apathetic, very much amaciated and backward in its physical development. The abdomen was very large. The face had a striking pale brown discoloration; there were a few mongol spots on the dorsum. The eyes were slanting and the facies were mongoloid. The abdomen measured 50 cm. The liver and the spleen were both enlarged; the spleen reached below the navel; the lower edge of the liver could be felt over the anterior-superior spine of the iliac crest. The abdominal veins were widely dilated. A small amount of free fluid could be demonstrated in the abdomen; there was slight edema of the feet, and other signs of venous obstruction were present. The blood was normal in every respect. There was no icterus. The stools were normal. The Wassermann reaction was strongly positive (?); a rigid mercurial treatment was absolutely ineffectual. The infant's condition became steadily worse; the symptoms of venous stasis became aggravated, and the infant died of exhaustion four weeks later. For a few days before death the patient had irregular temperatures up to 39° C. At necropsy no luetic changes were found in any of the organs. The spleen, the liver and the abdominal lymph-glands showed the same kind of cells found in the other authentic cases of splenomegaly Gaucher. Although the writer reports the case as one presenting "an unrecognized disease picture," one glance at the photomicrograph which is included in his article leaves no doubt that his was a true case of spenomegaly Gaucher.

Erdmann and Moorhead's[7] Case 1.—Parents are robust; no constitutional diseases. Henry, born March 1, 1901; breast-fed; weight at 1 year 18 pounds 4 ounces; abdominal protrusion first noted July 2, 1902; splenic and hepatic enlargement were noted at this time by Dr. W. C. Walsen; blood showed malarial parasites. The infant improved with treatment. January, 1903, the blood showed hemoglobin, 62 per cent.; red blood-cells, 3,912,000; white blood-cells, 4,600; small mononuclears, 12.5 per cent.; large mononuclears, 20 per cent.; polynuclears, 50 per cent.; basophils, 6 per cent.; eosinophils, 12.5 per cent. One month later child had colitis. September, 1906, blood was the same as in January, 1903; diagnosis of splenic anemia was made. January, 1907, the child had pneumonia; cough lasted all spring. The child died of pneumonia Oct. 27, 1909, after one day's illness; no necropsy. "At no time were any hemorrhages, except slight epistaxis. On one occasion, in the latter months, he vomited a great deal and often looked dark and blackened."

Second and third children were perfectly well and showed no splenic nor hepatic enlargement.

Erdmann and Moorhead's Case 2.—Fourth child, Elizabeth, was born Feb. 19, 1909; was breast-fed until 7 months; weight 14 pounds 10 ounces. Nov. 27, 1910, child had bronchitis, sick 10 days. At 1 year weighed 18 pounds. April 8, 1910, spleen was found slightly enlarged. Blood at this time: hemoglobin, 70 per cent.; red blood-cells, 2,956,000; white blood-cells, 14,000; small mononuclears, 13 per cent.; large mononuclears, 28.6 per cent.; polynuclears, 41 per cent.; eosinophils, 2 per cent.; basophils, 2 per cent.; myelocytes, 12.3 per cent.; transitionals, 1 per cent. At this time she seemed "rather nervous and hard to nourish. The only illness was slight colds." May 27, 1911, considerable increase in size of spleen; liver normal. Sept. 23, 1911, the liver was found to be enlarged. Feb. 21, 1912, blood examination showed hemoglobin, 56 per cent.; red blood-cells, 5,000,000; white blood-cells, 9,800; polynuclears, 45 per cent.; lymphocytes, 55 per cent. The spleen reached up to the umbilicus; the liver was moderately enlarged; no ascites. The abdominal veins were enlarged. The inguinal glands were enlarged, all others were normal. The Wassermann reaction was negative. Feb. 28, 1912, hemoglobin was 85 per cent.; red blood-cells, 6,200,000; white blood-cells,

7. Erdmann, J. F., and Moorhead, J. J.: Splenectomy for Splenomegaly (Gaucher Type), Am. Jour. Med. Sc., February, 1914.

7,000; small lymphocytes, 49.4 per cent.; large lymphocytes, 9.4 per cent.; polynuclears, 40 per cent.; eosinophils, 1 per cent.; basophils, 0.2 per cent.; no malarial parasites. March 2, 1912, the child was pale, poorly developed, somewhat dyspneic, abdomen protuberant, veins prominent, no ascites. The liver was 2 inches below the costal margin and extended well to the left. The spleen was firm, smooth, not tender and reached just below the umbilicus and well toward the median line. There was one enlarged lymph-node in the right inguinal region. There was no jaundice; no pigmentation. The sclerae were clear; the bones were normal. June 6, 1912, splenectomy was performed; histologic study of the spleen showed it to be a case of Gaucher's disease. "The striking lesion microscopically in the spleen is the presence of enormous numbers of large mononuclear cells. . . . The protoplasm is granular and stains faintly. A few of the cells contain vacuoles. Very rarely a cell with two or three nuclei is seen." Sections were also made by Mandelbaum, who found typical tubercles in addition. Nine days after the operation the blood was: hemoglobin, 85 per cent.; red blood-cells, 6,080,000; white blood-cells, 19,000; small lymphocytes, 24.4 per cent.; large lymphocytes, 20.4 per cent.; polynuclears, 52.6 per cent.; eosinophils, 2.2 per cent.; basophils, 0.4 per cent. September, 1912, child in good health; no dyspnea; no dilatation of surface veins; liver reaches about 1 inch below costal border; no inguinal adenitis. March 21, 1913, liver slightly larger than in September.

HERRMAN'S CASE.[8]—In March, 1912, Dr. Herrman presented before the pediatric section of the Academy of Medicine a case of splenic anemia in a boy of 12. Since then the boy had been subjected to a splenectomy and histologic examination of the spleen by Bernstein revealed that the patient was suffering from splenomegaly Gaucher. This boy had been under observation at the Vanderbilt Clinic since 1906, and among others I was firmly convinced that this was a true case of splenomegaly Gaucher long before the splenectomy was performed. The patient, Samuel N., was first observed in 1906 (7 years). Abdominal enlargement was first noticed at 4 years; abdominal pain for last six months; epistaxis three or four months ago. The blood showed: hemoglobin, 75 per cent.; red blood-cells, 4,390,000; white blood-cells, 4,000; polynuclears, 70 per cent.; lymphocytes, 29 per cent.; eosinophils, 1 per cent. Spleen extended beyond the median line and 3 inches below the level of the umbilicus. The liver extended 2 inches below the costal margin in the mammary line; no lymph-glands were distinctly enlarged. Blood examination in last five years: hemoglobin, 30 to 75 per cent.; red blood-cells, 2,560,000 to 4,600,000; white blood-cells, 2,400 to 6,800. In 1909 after extraction of a tooth there was oozing from the gums for some time, and one month later patient had abdominal pain and vomited a large amount of blood. There is no ascites. The Wassermann and von Pirquet tests are negative; there was bronzing of the skin of the face, the neck and the hands; a wedge-shaped conjunctival thickening on both sides, with the bases toward the cornea and the angles extending toward the nasal and temporal angles of the lids were present. The parents are healthy; eight other children all well; one died in infancy of convulsions. Since the patient was presented at the Academy of Medicine, splenic hepatic enlargement was observed in a sister of the patient.†

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8. Herrman: Report of Meeting of Pediatric Section of Academy of Medicine, Arch. Ped., March, 1912.

† Since my article was submitted for publication there appeared a subsequent report of this case by Drs. Herrman, Roth and Bernstein. (A Case of Gaucher's Disease in a Boy Thirteen Years of Age. Splenectomy with Recovery, *Arch. Pediat.*, May, 1914. On Oct. 17, 1913, the patient was admitted to Lebanon Hospital. During the preceding two weeks he had had several severe hemorrhages from the nose and gums and was very pale. On one occasion he lost 6 ounces of blood. The patient complained of feeling badly, had lost weight

HISTORICAL

In 1882, in a thesis for his doctor's degree, Gaucher reported the first case of the disease which now bears his name. He considered the malady to be a primary epithelioma of the spleen.

In all there are sixteen authentic families reported in the literature, in which the diagnosis was definitely established; of these patients eight were children and nine were adults at time of report.

Various opinions have been expressed as to the nature of the disease; as yet there is very little agreement of opinion. It has been variously described as an endothelioma of the spleen, and as a "hyperplasia of the spleen characterized by an unusual development of endothelial cells, and the transformation of a considerable part of the organ into dense connective tissue." Others have thought that the large cells arose from endothelium or normal reticulum in the hemopoietic apparatus. Schlagenhaufer considered the process to be a systemic disease of the lymphatic hemopoietic apparatus with proliferation of the reticular structures affecting the spleen primarily, then the regional and other lymph-nodes and finally, the liver and the bone-marrow. Von Herczel considered the spleen to be the seat of an inflammatory process or a new growth. It is evident that, while all are agreed as to the histological features of the lesion, the source and nature of the cells are still wrapped in mystery.

Various names have been suggested for this disease: "Gaucher's disease," "splenomegaly Gaucher," "large-cell glandular metamorphosis" (*grosszellige Drüsenmetamorphose*). As the hepatic enlargement in this disease is constant (in the advanced stages of the disease), and is of valuable diagnostic importance, and as its copresence with a large spleen is almost pathognomonic of this disease in children, I suggest the name of "splenohepatomegaly Gaucher" as one which gives a conception of the two most important symptoms of this disease and one which reflects credit on the discoverer of this ailment.

ETIOLOGY

Family Incidence.—The disease is undoubtedly congenital and usually affects more than one member in the same family; although it is familial it is not hereditary. In none of the cases here reported did the parents of any patient have this affection. Of the seven families here recorded there were three members affected in one family, two members each in five families, and one member in one

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and was troubled with headache, dizziness, dyspnea and nausea. Splenectomy was performed on Oct. 22, 1913. The patient made a good recovery and was discharged Dec. 11, 1913. The spleen in this case measured 27 by 13 by 10 cm., and weighed 1,320 gm.

family. The total number of children born in these seven families was forty-four; of these, eight died during infancy of other ailments, fourteen had splenic and hepatic enlargement; the diagnosis was definitely established on necropsy or by examination of the spleen after splenectomy in eight cases.

Sex.—Of the eight patients in whom the diagnosis was definitely established, six were females and two were males; the case here reported being the first of a male child to be recorded. If we include the six other members of the families in whom the diagnosis was not definitely but presumably established, there were ten females affected and four males.

Age.—The youngest child reported was 17 months old. Arranged according to age at time of report, they were respectively: 3½, 4, 6, 6, 8, 8½, 10, 12, 13, 14½, 15 and 17 years old. The earliest splenic enlargement was observed in one case at 2 months; in two cases at 1¼ years; in two cases at 3 years; in two cases at 4 years, at 6½, 7½ and at 8 years; so that on the average the first splenic enlargement was noted at 3¾ years.

PATHOLOGY

In five of the eight authentic cases, necropsies were performed, and in three the spleens were examined after operation. In the eight examinations of the spleens, the findings were almost identical in all the cases; Bovaird was first to note similar changes in the mesenteric glands, and Mandelbaum and Libman were the first to find the endothelial hyperplasia in the bronchial and retroperitoneal glands and in the bone-marrow.

Macroscopic Examination.—The liver is firm and smooth over the greater part, and is usually much enlarged; there is evidence of old and new infarcts; on section it is chocolate colored and there are numerous small white areas.

The spleen is much enlarged; the form of a normal spleen is retained; on the external surface fibrous adhesions are present; the surface is white to yellow, and in general is smooth; the fibrous coat is thickened; the substance is firm and resistant.

The appearance of the cut section varies; a central section shows firm yellow-white areas of pyramidal form; the remainder has the appearance of normal spleen.

Lymph-nodes are enlarged and soft; on cross-section the central parts are deep red and the periphery is pale.

Microscopic Examination.—Spleen: Sections from hard white areas differ from other sections that have the appearance of normal splenic tissue. In the latter sections there are large irregular spaces

filled with large, brightly stained cells. The walls of these spaces consist in part of a delicate line of connective tissue with infrequent small oval nuclei; adjoining spaces communicate with one another by narrow passages. The cells within the spaces are very large, and are of varied shape; many lie free in the spaces; these cells are round or oval. The nuclei vary considerably in size and shape; as a rule, they are very small in proportion to the size of the cell. There are also in some places giant cells. These spaces are the pulp spaces of the spleen, and the cells that fill them have sprung from their walls. The normal pulp cells have disappeared. On the other hand, the malpighian bodies are met with almost unchanged. The connective tissue in some places is so abundant that the spaces contain but one cell.

Sections from the white areas consist of dense connective tissue. In part this is infiltrated with small round cells; in other parts seems to be made up of a meshwork of capillaries.

Capsule and trabeculæ are greatly thickened. The blood-vessels are surrounded by a greatly increased quantity of connective tissue.

The malpighian bodies "seem very little affected by the great changes that have gone on about them."

Liver: The capsule is thickened and the connective tissue throughout the organ is increased; the capillaries contain considerable pigment; the liver cells are normal; the bile ducts are normal; in the blood that fills the branches of the portal vein there are large cells of the type seen in the pulp spaces of the spleen. Endothelial cells are mostly seen in the interlobular connective tissue spaces; a few are seen in the lobule proper.

Lymph-Nodes: These are swollen, red and soft; each follicle is outlined by a wall of brightly shining, dark pigment. The part of the lymph-sinus not occupied by pigment is nearly completely filled with the above-described endothelial cells.

Bone-Marrow: Cells identical with those found in the above-described organs are also found in abundance in the bone-marrow.

SYMPTOMATOLOGY

1. *Enlargement of the Spleen.*—One of the first symptoms and signs noted by the parents and the patients is a mass in the left hypochrondrium; this mass is not tender. There is a gradual but progressive enlargement of the spleen. The increase in size of the spleen in this disease is not surpassed by splenomyelogenous leukemia; it is surprising how large the spleen may become without causing any great inconvenience to the person, and the enlargement of the spleen takes place a long time before any secondary symptoms arise. In many cases the condition is discovered accidentally, when the patients apply

for treatment for other ailments. In almost all the cases the spleen passes the median line and the lower portion well fills the iliac cavity. The smallest spleen weighed 490 gm.; the largest spleen weighed 6,200 gm. The average of five spleens was 1,097 gm. The normal average weight of these five spleens should have been about 120 gm.; the spleens from the affected cases weighed from five to forty times as much as the normal spleens should have weighed. One obtains a better idea of how large the spleen may become in this disease, when we note that in Case 1 of Collier, the child weighed 23 pounds and the spleen weighed 4 pounds 2 ounces; and in Case 2 of Bovaird the child weighed 78 pounds and the spleen 12½ pounds. In health the relation of the spleen to body weight is as 1:400; in the last two cases, it was as 1:5 and 1:6.

Enlargement of the Liver.—In all the cases but one there was a concomitant enlargement of the liver; in Case 5 there was no vertical enlargement, but the liver was enlarged horizontally toward the left; however, after splenectomy the liver began to enlarge in the vertical direction also; this also occurred in Case 12. In two of the cases there was no hepatic enlargement when the spleen was definitely enlarged. It can be definitely stated that the splenic enlargement is primary and the hepatic secondary; sooner or later, however, hepatic enlargement takes place. In every authentic case of this disease, in the later stages, a hepatic enlargement could be demonstrated. In some cases, the liver increased in size proportionally to the spleen; in others it was slightly enlarged. In Case 10 the liver was larger than the spleen.

Enlargement of the Lymph-Nodes.—The lymph-nodes are usually normal. In Cases 3 and 4 there was slight enlargement, but I think we cannot positively rule out specific infection. There is a history of a stillbirth at 8 months, and four deaths in early infancy in that family. I am of the opinion that the glandular enlargement was probably due to an underlying luetic infection. Patient 12 had one enlarged inguinal gland; Patient 14 had palpable but not enlarged glands in the axilla and in the groins.

Blood-Changes.—The blood shows usually a mild anemia. The anemia varies from time to time and is subject to various grades of improvement; only in the later stages of the disease does it become progressive. In the stage at which there is no anemia, the red blood-cells may be up to 6,000,000. When anemia is present, they may be as low as 2,560,000. There is little, if any, change in the contour, shape or size of the red cells. The color may be paler than normal. In only two of the cases have nucleated forms been observed; in these a solitary normoblast was seen in each.

The white blood-cells are usually diminished in number, even when the red blood-cells are not. The lowest white blood-cell count was 2,500; the average white blood-cell count in nine cases was 5,160. A persistent leukopenia in the absence of anemia is a very suggestive symptom. Case 12 was the only one which at any time during the course of the disease had a leukocytosis, but even in this case there were periods of leukopenia. The hemoglobin varies with the anemia; usually there is greater reduction in the hemoglobin content than in the number of the red blood-cells, giving rise to a low color-index, and therefore of a mild anemia of the chlorotic type. It was as low as 30 per cent. in Case 14 and 35 per cent. in Case 9.

The differential count is usually normal; however, in Cases 5, 6 and 12 an eosinophilia of 10, 3.3 and 12.5 per cent., respectively, was found on various examinations. In all the cases reported, one or two myelocytes were found at every blood examination. In one examination in Case 12, 12.5 per cent. myelocytes were found. In all the cases in which there was leukopenia before operation, there was a leukocytosis of from 14,000 to 20,000 after splenectomy. Bone tenderness was not noted in any of the cases. Abdominal pain, especially over the splenic area, fulness and dragging sensation were noted in nearly all the cases.

The pigmentation has been variously described, varying from a brownish bronzing and Roman gold color, to a yellow, light yellow icteric hue. The pigmentation is seldom diffuse and usually affects the face, neck and extremities, the bridge of the nose, around the eyes and the cheeks being favorite spots. Pigmentation of the abdomen was observed in Cases 5 and 6. Mongol blue spots were observed in two cases. A brown-yellow wedge-shaped thickening of the conjunctivae of both eyes was observed in Case 14. This symptom is of some significance as it has also been observed in several authentic adult cases of this disease.

Hemorrhages as a rule are not severe, and are usually in the form of epistaxis or oozing from the gums. They are usually frequent; spongy gums were observed in five cases; menorrhagia and hematemesis were each observed once, in different cases.

Jaundice was not present in any one of the authentic cases; bile is not present in the urine and urobilinuria is not increased to any appreciable extent. The stools are normal and contain bile. Ascites is usually absent; in Case 10, slight ascites was present a few days before death. The superficial abdominal veins were dilated in a majority of the cases.

General Symptoms.—As the spleen and the liver become larger, the children begin to complain more and more of abdominal pain,

general discomfort, weariness and dyspnea. As the disease progresses and the anemia becomes more marked, emaciation becomes extreme. Patient 1 weighed 23 pounds at 6 years and Patient 4, 78 pounds at 16 years.

COURSE OF THE DISEASE

In infants and young children the disease is slowly progressive with a certain number of remissions. The younger the child is when the first splenic enlargement appears, the graver is the prognosis. This disease does not run so benign a course as it does in adults. Adults on the average live about nineteen years after they have contracted this disease and may live as long as thirty-six years after its inception. Adults afflicted with this disease usually die of some intercurrent affection. Infants and children, on the contrary, usually die of asthenia or rupture of the spleen brought about by the disease itself. In the fourteen cases, reports of which are here collected, seven patients died, five of the disease itself and two after splenectomy; Patient 4 being hopelessly moribund from the disease before operation. The prognosis in children is far graver than it is in the adult type of the disease, unless splenectomy is performed early. There are not sufficient data at hand to prove or disprove that splenectomy brings about a cure. Of the five cases in which splenectomy was performed, in two the patients died immediately after operation, and in the three patients who survived, the hepatic enlargement progressed after the splenectomy. Certainly splenectomy produces no such wonders in this disease as it does in Banti's disease and in splenic anemia. It relieves all the symptoms, but whether it produces a cure we have not sufficient data, pro or con. The three cases in which the patients survived splenectomy have not been observed sufficiently long to draw any definite conclusions from them. The pathologist must also tell us whether the lesion begins in the spleen and then spreads to the other blood-forming organs, or whether the power for the disease to progress lies latent in the other organs, and may become active even when the spleen is removed. Definite knowledge on this point is lacking. There is no agreement of opinion among the pathologists on this point. Some assert that the spleen is the primary seat of the disease and that the large cells in the course of the disease are transported to the other blood-making organs and there proliferate. In accordance with this view an early splenectomy should result in a cure. Others maintain that although the spleen is the first of the hemopoietic organs to show activity in this disease, the other blood-forming organs have the power latent in them from birth to become active and may cause enlargement of the liver, even after the spleen is removed. According to this view, splenectomy cannot stop the progress of the disease; it

can only relieve the symptoms due to the size and the weight of the spleen. In the progressive cases of infants and children, however, splenectomy is the only measure to be thought of for the temporary relief, if not for the cure of the disease, as the size of the spleen may be a direct menace to life on account of the danger of rupture. All other measures are futile.

DIAGNOSIS

This disease is not a manifestation of tuberculosis or syphilis. The Wassermann reaction was negative in Cases 5, 9, 12 and 14; it was positive in Case 10 (?), but on necropsy there was found not the slightest evidence of luetic infection.

In the stage of prehepatic enlargement, the following points are of diagnostic importance: the familial nature of the disease; persistent leukopenia, even in absence of anemia; progressive enlargement of the spleen in spite of the improvement of the anemia, if present, is almost pathognomonic; the conjunctival thickenings; the absence of all etiologic factors; the absence of jaundice, ascites, urobilinuria and fever, and splenic puncture. This procedure is hardly even used in the United States; in Italy, especially Florence, where it has been extensively tried, very few untoward complications have been observed from its use; as in very young children and in infants this disease is almost invariably fatal, a splenic puncture for diagnostic purposes should be performed in every case in which this disease is suspected; if examination of this material reveals it to be a case of Gaucher's disease, splenectomy should be urgently recommended, for it is these cases without hepatic enlargement that offer the best hope of permanent relief and cure of this disease.

In the stage in which both the spleen and the liver are enlarged, the diagnosis can more readily be made. There is no other disease of infancy and early childhood in which the liver and the spleen assume such enormous proportions; splenomyelogenous leukemia not excluded; this disease runs an afebrile course except in its terminal stage; here too the other symptoms are of great importance in arriving at a correct diagnosis; the familial predisposition; the persistent leukopenia; the conjunctival thickenings; absence of jaundice, ascites and urobilinuria; the presence of a brown yellow pigmentation, especially on the face, neck, extremities and the abdomen; the presence of oft-repeated but slight hemorrhages, mostly in form of epistaxis and oozing from the gums, which are usually spongy; the absence of all symptoms when anemia is not present, in spite of an immense liver and spleen; the progressive enlargement of the spleen and the liver, in the anemic stage, even when the anemia under treatment is rapidly disappearing; the absence of all glandular enlargement, and finally splenic or hepatic puncture.

DIFFERENTIAL DIAGNOSIS

The diseases from which it is especially to be differentiated are splenic anemia in adults and von Jaksch's disease in infants. Under the term "splenic anemia," Osler includes all those cases of idiopathic enlargement of the spleen associated with anemia, which were formerly classified as splenic pseudoleukemia, anemia splenica, lymph adénie splénique and splenic form of Hodgkin's disease. He states: "I purposely have not spoken of anemia with enlarged spleen in very young children, a subject which requires separate consideration."

The entity of splenic anemia is not at all granted. Stengel in his paper on "Splenic Anemia" says: "I have elsewhere expressed doubt regarding the individuality of such a condition and the conviction that many different sorts of diseases have been classed under this term."

The differential points will be noted from the following:

ANEMIA SPLENICA	SPLENOMEGALY (GAUCHER)
Family Incidence: Not more than one in a family.	Three families with two cases; two families with three cases.
Sex: Males, 39 out of 47.	Females: 12 out of 16.
Age: Low limit (9-20) High limit (58-72).	Low limit (3-13) High limit (30-41).
Pathology: Spleen shows a hyperplastic fibrosis, involving particularly the malpighian bodies.	Spleen, liver, lymph-glands and bone-marrow show endothelial hyperplasia.
The liver shows no characteristic changes	
The lymph-glands are not enlarged and show no changes.	
The bone-marrow shows compensatory changes, secondary to secondary anemia.	
Chronicity: Four to ten years.	Three to thirty-six years.
Splenomegaly: Large.	Larger.
Size of smallest spleen, 790 gm.	Smallest, 430 gm.
Size of largest spleen, 5,670 gm.	Largest, 7,000 gm.
Average of fifteen cases, 1,883 gm.	Average of nine cases, 4,300 gm.
Anemia: Secondary type.	Simple anemia.
Average red blood-count, 3,425,000	Average, 4,000,000 reds; 5,600 whites; Hgb. 70 per cent.
Average white blood-count, 3,850	
Average Hgb. estimation, 47 per cent.	
Hemorrhages: As a rule, hematemesis in one-half the cases; severe.	Rarely hematemesis, but epistaxis and oozing from the gums.
Ascites and edema: Occasionally seen.	Never.
Jaundice: Moderate in degree; veins in association with cirrhosis of the liver.	Never.
Liver: Is of normal size in most cases.	Greatly enlarged in a majority of the cases.

BANTI'S DISEASE	SPLENOMEGALY (GAUCHER)
Sex: Female 32 out of 50 cases.	Females 12 out of 16 cases.
Heredity: Not congenital; does not affect more than one member of the same family.	Is probably congenital; usually affects more than one member of the same family.
Age: Youngest of 50 patients is 12 years; oldest of 50 patients is 55 years.	Youngest recorded is 7 months; oldest recorded is 41 years.

BANTI'S DISEASE	SPLENOMEGALY (GAUCHER)
Spleen much enlarged.	Larger.
Liver at first of normal size; then becomes enlarged, and later diminishes in size.	Always enlarged.
Jaundice sometimes present.	Never present.
Ascites usually present.	Never present.
Blood: R. B. C., 4,330,000; W. B. C., 3,800; Hgb., 56 per cent.	R B. C., 4,200,000; W. B. C., 6,000; Hgb., 70 per cent.
Hemorrhages: Usually severe, in the form of hematemesis.	Never severe; usually epistaxis or oozing from the gums.
Duration seven to ten years.	Three to thirty-six years.
Death: Usually due to intoxication from cirrhosis of liver or to severe hemorhage.	Usually due to intercurrent disease.
Pathology: There is a fibrosis of the reticulum of the spleen, the liver and the portal vein. Bone-marrow and lymph-glands are normal.	There is an endothelial hyperplasia of the spleen, the liver, the lymph-glands and the bone-marrow.

In children it is most important to differentiate splenomegaly Gaucher from von Jaksch's disease (anemia pseudoleukemica, or according to more recent nomenclature, anemia splenica infantum). Differential points are as follows:

SPLENOMEGALY (GAUCHER)	VON JAKSCH'S DISEASE
1. Always primary.	1. Usually secondary to gastro-intestinal disease, malnutrition, tuberculosis, lues, etc.
2. Usually affects children between the ages of 2 and 4 years.	2. Affects children between 6 months and 2 years.
3. Discoloration usually yellow or orange; more marked in some parts.	3. No discoloration, but there is extreme pallor of whole face, which may be olive color.
4. Spleen much larger; weighs 1,500 gm.	4. Spleen enlarged but not to the same extent seen in S. (Gaucher). Spleen weighs 350 gm.
5. Liver usually enlarged.	5. Liver usually not enlarged.
6. Glands (lymph) never enlarged.	6. Lymph-glands sometimes enlarged.
7. Blood: Red blood-corpuscles, 4,100,000; white blood-corpuscles, 5,600; Hgb., 70 per cent.	7 Blood: Red blood-corpuscles, 2,500,000 to 3,000,000; white blood-corpuscles, 10,000 to 20,000; Hgb., 45 per cent.
No abnormal cells found.	Myelocytes and normoblasts up to 25 per cent in many of the cases.

In infancy syphilis and rickets are the most frequent causes of splenic enlargement; luetic splenomegaly is most common in the first three months of life and slightly declines as a cause of splenomegaly after this period, but even at from 9 to 12 months it is an important cause of such enlargement; rickets is the most frequent cause of splenic enlargement in infants after the ninth month; the absence of all other rachitic manifestations, makes differential diagnosis from this disease simple. Not one of the authentic cases showed any manifestations of lues, and in four out of five infants in whom the Wassermann reaction was tried, the reaction was negative.

There are several conditions which have a tendency to be familial and are associated with splenomegaly; the most important of these are: hypertrophic biliary cirrhosis (Hanot's cirrhosis), congenital hemolytic jaundice with splenomegaly, congenital obliteration of the bile ducts and Wilson's disease. Von Jaksch's disease, already differentiated, has been known to occur in three members of the same family, and in several instances in both of twins.

Hanot's cirrhosis is more common in males; the liver in this disease undergoes considerable uniform enlargement; the spleen is also enlarged and it may even become larger than the liver; there is jaundice, which becomes deeper during the "crises"; the urine contains bile; a moderate leukocytosis is present during the febrile periods, both of which are absent in Gaucher's disease; clubbing of fingers, deformities of the nails and other osteo-arthropathies have been described in children; the pigmentation is more extensive and the hemorrhages more severe than in splenomegaly Gaucher. This disease is sometimes encountered in several members of the same family, and it may be found in more than one generation of the same family; it is interesting to note that, in some members of these families, the spleen is enlarged though no symptoms are present.

In acholuric family jaundice, the jaundice appears at birth, or in later childhood; there is a general history of jaundice in other members of the same family; the urine is usually free from bile (acholuria); the condition is a chronic one and does not seriously endanger life except in early infancy; it is hereditary and has been traced for several generations in one family; both sexes appear equally affected; there is usually a slight enlargement of the liver and greater enlargement of the spleen; anemia may be severe and may prove fatal; normoblasts and megaloblasts are present. The jaundice may disappear to reappear at intervals in later life and thus obscure the diagnosis. The leukocytes are not affected in any characteristic way. There is an increased fragility of the red blood-cells, and there is a peculiar basophilic granulation of the red blood-cells on vital staining; on necropsy marked siderosis of all the viscera is found.

From congenital obliteration of the bile-ducts splenomegaly Gaucher is differentiated by the absence of a progressively increasing jaundice and severe hemorrhages and by its much more chronic course; the longest that infants have lived with this disease is ten months.

Kennier Wilson described a familial form of cirrhosis of the liver which is apt to occur in childhood; but the presence of mental symptoms easily differentiates this disease from splenomegaly Gaucher. In this disease various forms of disturbances of the central nervous system are present, giving rise to emotionalism, tremors, muscular rigidity,

contractions and mental symptoms. Signs of hepatic disease are usually absent during life; these cases are usually fatal; the average duration is 4 years.

In the anemic stage, Gaucher's disease is to be differentiated from the various forms of anemia and leukemia, splenic anemia, lues, tuberculosis, malaria, uncinariasis, kala-azar, malignant endocarditis, sepsis, new growths, primary and secondary, and mechanical obstruction to the portal circulation, as cirrhosis of the liver.

Examination of the blood will reveal the true nature of the blood diseases and of polycythemia with splenomegaly (*maladie de Vaquez*). Primary tuberculosis of the spleen is rare; there are usually other foci of tuberculosis present, polycythemia is often present in these cases, which is of diagnostic value; examination of the stool for ova will reveal the cause of the anemia if due to hookworm. Malaria can be easily ruled out on the absence of history of infection and on the examination of material from splenic puncture; the liver never assumes such large proportions in chronic malarial splenomegaly.

In the afebrile period of kala-azar differential diagnosis may be very difficult. The anemia is more severe in kala-azar and is usually progressive; the spleen and the liver are enlarged, but not to the extent that is seen in splenomegaly Gaucher. Sooner or later the fever returns; it is irregular and different in every case, and this irregularity is of very great diagnostic value. Hemorrhages are frequent and severe, and may have epistaxis, hematemesis, melena; the blood shows a leukopenia, with a relative lymphocytosis; positive diagnosis is made by the finding of the Pianese or of the Leishman-Donovan bodies in the blood, liver, spleen or bone-marrow. This disease runs a much shorter course (from five months to one year, subacute form; from two to three years, chronic form) and is almost invariably fatal.

Other diseases from which it is to be differentiated are, aleukemic leukemia, cirrhosis post leukemia, status thymicus, cirrhosis post myxedema, and the cirrhosis due to different causes as alcoholic, hematogenous, cardiac, metabolic, chromatic, adenomatosa and that due to tuberculosis, distoma and infections.

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SUBACUTE ATROPHY OF THE LIVER

OCCURRING IN A CHILD FIVE MONTHS OF AGE *

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Subacute atrophy of the liver has been described by several authors during the past few years. It is a condition which closely resembles acute yellow atrophy of the liver in its etiology and initial symptoms, but it differs from acute yellow atrophy in that the progress of the disease is less acute, the onset of the second or terminal stage is delayed or absent, and fatal termination does not occur for weeks, months or even years after the initial symptoms. The condition is very rare. McDonald and Milne[1] collected the reports of the fifteen cases which had been reported previously to 1909, and added five new cases. Milne[2] has since reported one more case, and Fordyce[3] had added another. In a fairly complete review of the literature I have been unable to find any other reported cases, although Milne mentions having seen specimens of four cases which have not been reported. In view of the infrequency of the condition it would seem justifiable to report the following case:

REPORT OF CASE

Baby C. was an apparently normal, 8-pound baby, the first child of young and healthy parents. He was breast-fed for about two months, after which he was placed on a formula diet. He thrived and steadily increased in weight. When about 2 weeks old he became deeply jaundiced, although there was no gastro-intestinal disturbance and no other sign of illness. The stools were not acholic. The child continued to grow and was apparently healthy, although the deep jaundice persisted. Dr. R. Langley Porter was called in consultation on account of the persisting jaundice when the child was about 3 months of age. He found a well-grown, well-nourished child which showed no abnormality except a marked jaundice, a palpable spleen and a slightly enlarged liver. The stools were not acholic and the child appeared healthy and happy. The blood of the child and of the parents gave a negative Wassermann reaction. Dr. Porter believed that the case was one of persistent icterus neonatorum. The child was seen only occasionally by the attending physician during the following weeks, but regular reports were received from the parents, who said that he was steadily gaining in weight although the jaundice persisted. Two months after Dr. Porter saw him, the child was seized with extreme respir-

* From the Division of Pathology of the Stanford University Medical School.

1. McDonald and Milne: Subacute Liver Atrophy, Jour. Path. and Bact., 1908-09, xiii, 161. Contains a complete bibliography.

2. Milne, Lindsay S.: Subacute Liver Atrophy, Arch. Int. Med., 1911, viii, 5, 639.

3. Fordyce, A. D.: Case of Subacute Liver Atrophy in a Child, Proc. Roy. Soc. Med., 1910, iii, Part 1 (section for the diseases of children), p. 1.

atory distress, and there was marked abdominal distention which was thought to be due to intestinal gas. All efforts failed to relieve the condition of the patient, and Dr. Porter was again called in, but the child died before his arrival. Death occurred about twenty-four hours after the onset of the acute symptoms.

Partial necropsy was performed by Dr. Porter about twenty-four hours after death, and the organs were brought to the pathologic laboratory of the Stanford University Medical School for examination.

Necropsy Report.—The body was that of a well-grown, well-nourished male child of 5 months of age. There was marked jaundice of the skin and of the visible mucous membrane. There was a large hernia on the right side, which showed no evidence of strangulation. The abdomen was markedly distended and the flanks bulged prominently. The subcutaneous fatty tissue was well developed. The abdominal cavity contained about 3½ pints of deeply bile-stained fluid, but the pericardium and the heart were apparently normal excepting for the marked icteric staining. The lungs were about normal in size, but showed some emphysema and some hyperemia and edema. There were a few hemorrhages beneath the visceral pleura. The peribronchial lymph-nodes were not enlarged. The spleen was large (9 by 7 by 5 cm.), smooth and firm. It was dark in color and the markings were not distinct.

The kidneys were very large (8 by 5 by 3.5 cm.), and showed the usual fetal lobulation. The capsules were not thickened and were not adherent. The surface of the kidney was mottled and opaque and showed several small hemorrhages. The cut surface was opaque and distinctly bile-stained. The bladder was filled with bile-stained urine. The adrenals were apparently normal.

The intestines contained fecal material which was well stained with bile.

The liver was very small (14 by 9 by 5 cm.), and was dark green in color. The capsule was not thickened, but the surface was everywhere finely granulated. The liver-tissue was very firm, and cut with considerable difficulty. It was everywhere dark green in color, and showed no definite lobular marking. Immediately beneath the surface was a narrow zone, about 3 mm. in thickness, in which there were many small nodules separated by narrow bands of denser, more grayish-colored tissue. In many places these nodules corresponded to the small irregularities on the surface of the liver. The gall-bladder was small but apparently normal, and contained bile. The larger bile-ducts were carefully dissected out, and showed no stenosis.

Microscopic examination of the liver showed complete absence of the normal liver structure. Around the periphery of the organ was a narrow zone of living tissue, the narrow, nodular zone described above, in which the nodules consisted of irregularly arranged accumulations of large cells, which were usually multinucleated, but which bore a close resemblance to liver-cells. The protoplasm of these cells stained clearly and showed but little evidence of fatty degeneration. The nuclei stained well, and where multiple, were often arranged around the periphery in such a way as to suggest a transverse section through an imperfectly formed tubule. In the center of these large cells was often an accumulation of bile pigment. A few of the cells in the nodules contained single, very large, deeply staining nuclei. There was no evidence of karyokinesis.

Between the nodules was a very cellular newly formed connective tissue interstitial substance, in which were many newly formed bile-ducts. For the most part these bile-ducts showed no communication with the interlobular bile-ducts or with the remnants of liver-cells, but here and there one was found which seemed to pass directly into one of the multinucleated structures. Scattered irregularly through the interstitial tissue were many isolated cells or bunches of cells which closely resembled liver-cells. Some of these cells contained but one nucleus, but many were multinucleated, and many contained bile pigment.

Beneath the narrow zone of living tissue was wide-spread necrosis which involved practically the whole of the liver, and in which all resemblance to normal liver structure was lost. The greater part consisted of fibrous tissue which contained practically no nuclei, and which stained very poorly with van Giesen's connective tissue stain. Scattered irregularly through this connective tissue were remnants of liver-cells which had completely lost their nuclear staining, and which contained many fat droplets and much bile pigment in their protoplasm. There was very little evidence of the interlobular bile-ducts, no new formation of bile-ducts, and no evidence of regeneration of liver-cells in this deeper necrotic portion, which formed by far the greater part of the total volume of the organ. There was no demonstrable lesion of the blood-vessels.

Sections of the kidneys showed marked destruction of the epithelium of the convoluted tubules, with complete necrosis in many places. The lumens of many of the tubules were completely blocked with desquamated epithelium and debris, and there was marked fatty degeneration of the still living epithelium. In places there was evidence of regeneration of the epithelial cells, but no karyokinesis was seen. Many of the smaller and collecting tubules contained bile-stained casts. The glomeruli showed practically no change. There was fairly wide-spread, somewhat patchy proliferation of the interstitial connective tissue which was quite cellular in type, and which contained many round cells. The blood-vessels were apparently normal.

Sections of the spleen showed marked passive congestion and beginning proliferation of the connective tissue of the pulp.

The pancreas and the thymus showed some irregular increase in the interstitial connective tissue, but the arteries were apparently normal.

The lungs showed some irregular areas of collapse, and moderate desquamation and fatty degeneration of the alveolar epithelium.

The adrenals showed no lesions excepting a few small hemorrhages into the medulla.

The diagnosis of the condition in this case presents considerable difficulty. At first sight the fibrosis in the liver, especially when associated with the beginning proliferation of connective tissue in the kidneys, pancreas and thymus, and with the medullary hemorrhages in the adrenals, suggests that the condition might be syphilitic. The complete absence of demonstrable lesion in the blood-vessels and the three negative Wassermann reactions, however, indicate that syphilis is probably not the etiologic factor in this instance.

The patency of the larger bile-ducts was easily demonstrated, and the presence of bile in the stools at all times precludes the possibility of the condition being due to a congenital stenosis of the biliary passage. Milne[4] has reported a case of congenital stenosis of the bile-ducts in which the macroscopic appearance of the liver was apparently very similar to that in this case, but the microscopic picture was entirely different.

There seems little doubt that the case can best be described as one of subacute atrophy of the liver in which the onset was not accompanied by severe gastro-intestinal disturbances, and in which no

4. Milne, Lindsay S.: The Histology of Liver Tissue Regeneration, Jour. Path. and Bact., 1908-09, xiii, 127.

definite etiological cause could be established. It is barely possible that there may have been an unrecognized infection of the cord which was responsible for the process, but certainly there was no reaction on the part of the patient which would suggest even a mild infection at the time of or preceding the appearance of the jaundice. In seven of the reported cases there was no recognizable etiologic factor, and they are described as being of insidious onset, and it seems justifiable to include this case in that group. The clinical history of the whole course of the disease is unfortunately not complete, but the examination made by Dr. Porter two months before the child's death showed that at that time, the liver and the spleen were larger than normal. This initial enlargement of the liver and the persisting enlargement of the spleen has been described in several of the reported cases.

The gross appearance of the liver differs somewhat from that of the majority of the reported cases in that the whole of the organ was stained dark green with bile. In the majority of the cases the livers were mottled in appearance owing to the presence of yellow nodules which were separated by a dark red "spleen-like" substance, but in one case described by Hlava,[5] and in another described by Jores,[6] portions of the liver were said to be dark green in color.

The gross appearance differs also in the regularity of size, and in the peculiar distribution of the nodules of regenerated liver-cells. In this case there is no evidence of a diffuse distribution of nodular hyperplasia, but practically all of the living tissue of the liver is found in a narrow zone, not more than 2 or 3 mm. in thickness, which lies immediately beneath the capsule. The distribution reminds one of the narrow layer of living tissue which is found immediately beneath the capsule in anemic necrotic infarction of the kidney. It is possible that the survival of this peripheral zone of tissue may depend on a partial blood-supply from the capsule, as is the case in the kidney, which enabled the peripheral cells to resist more effectively the toxic agent which caused the necrosis in the remaining portion of the liver.

The microscopic appearance of the living tissue corresponds closely to that described by the various authors with the exception that the nodules are all very small and are approximately of the same size. It is probable that the nodules represent areas of hyperplasia and proliferation of preexisting liver cells which survived the action of the toxic agent. The interstitial tissue, too, resembles that described by others. The newly formed bile-ducts are quite numerous, but for the most part could not be traced either to the preexisting interlobular bile-ducts, or to the cords or the remnants of cords of liver-cells.

5. Hlava, J.: Ein Fall von chronischer gelber Leberatrophie, Prag. med. Wchnschr., 1882, vii, 303 and 313.

6. Jores: Zur Kentniss der subakuten Leberatrophien, Verhandl. d. deutsch. Path. Gesellsch. f. Chir., 1908, xi, 320.

In a very few places the new bile-ducts seem to pass directly into a multinucleated mass of protoplasm which resembles liver-cell protoplasm, and which apparently corresponds to the "knob" which was described by Klebs,[7] and later by Meder[8] and others, but the number of these "knobs" is so small that one would not be justified in attempting to determine their significance.

SUMMARY

The case is one of severe jaundice of obscure origin, occurring in a child 2 weeks of age, and persisting without intermission until the death of the child at 5 months of age. The child grew and developed in a normal manner, and was never acutely ill until within twenty-four hours of death. When the child was 3 months of age, the liver and the spleen were found to be enlarged, but no other abnormalities were found. The stools were not acholic at any time during the progress of the disease, and the Wassermann reaction was negative. Death was preceded by severe respiratory distress and there was marked abdominal distention. No history of convulsions was obtained.

Necropsy revealed a marked ascites, a small granular liver, a large indurated spleen, and large kidneys which showed marked parenchymatous degeneration. There was extreme general icterus, but no demonstrable stenosis of the bile-ducts.

Microscopic examination showed complete necrosis of the whole of the liver with the exception of a narrow zone around the margin where there was evidence of regeneration of liver tissue. The spleen, kidneys, pancreas and thymus showed some beginning fibrosis, but the blood-vessels in all the organs were apparently normal. There was marked parenchymatous and fatty degeneration and also necrosis of the renal epithelium.

The most interesting points in connection with the case are the following:

The obscure origin of the condition.

The remarkably little effect produced on the growth and development of the child.

The persistence of bilary secretion in the presence of extreme destruction of the liver tissue.

The persistence of life, and the absence of evidences of hepatic insufficiency when so small a portion of living liver tissue remained.

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7. Klebs (1868): Cited from Meder (see Note 8), and from McDonald and Milne (see Note 1).

8. Meder, E., Ueber acute Leberatrophie, mit besonderer berückischtigung der dabei beobachteten Regenerationsercheinungen, Beitr. sur. path. Anat. u. zur. allg. Path., 1895, xvii, 143.

A STUDY OF TUBERCULOUS LESIONS IN INFANTS AND YOUNG CHILDREN, BASED ON POST-MORTEM EXAMINATIONS *

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From July 1, 1908, until April 1, 1914, a period of almost six years, 1,320 autopsies were performed at the Babies' Hospital of the City of New York. Of these subjects 178 showed tuberculous lesions, or 13.5 per cent. of the total number, a proportion slightly lower than Lubarsch[1] found among 747 children up to the age of 5 years. Lubarsch's examinations extended over a period of five and one-half years, and he found 128 cases of tuberculosis, or 17 per cent. A study[2] of the earlier Babies' Hospital cases showed 16.4 per cent. tuberculous cases among 1,131 autopsies. The contrast with adult percentages is very striking, whether we accept Lubarsch's figures, 69.2 per cent., or those of Naegeli,[3] 93.1 per cent. as the average.

In age the cases included in our study varied from 2½ months to 5 years, as follows:

2		were 2½ months old.
21		were from 3 to 6 months old.
23		were less than 6 months old.
50		were from 3 to 6 months old.
73		were less than 1 year old.
	36	were from 12 to 18 months old.
	25	were from 18 to 24 months old.
	61	were from 1 to 2 years old.
134		were less than 2 years old.
	28	were from 2 to 3 years old.
162		were less than 3 years old.
	16	were from 3 to 5 years old.
178		

It will be seen that 75 per cent. of our subjects were under 2 years of age, and it is these young children who present the most interesting material for study. There was no instance of congenital tuberculosis in the series.

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* From the Laboratory of the Babies' Hospital of New York City.

1. Lubarsch: Virchow's Arch. f. path. Anat., 1913, ccxiii, 417.

2. Wollstein, M.: The Distribution of Tuberculous Lesions in Infants and Young Children, Arch. Int. Med., 1909, iii, 221.

3. Naegeli, cited by Lubarsch (see Note 1).

This collection of cases divides itself into two main groups, according as to whether the lesions in the lungs and bronchial lymph-nodes were the predominating feature, or whether the lesions in the intestinal tract and mesenteric nodes were more marked. These two main groups may be subdivided as follows:

I. Pulmonary group:
  1. Tuberculous lesions limited to the bronchial lymph-nodes.
  2. Tuberculous lesions involving the bronchial lymph-nodes and one other organ:
     (*a*) Lung.
     (*b*) Pia mater.
     (*c*) Fingers.
  3. Tuberculous lesions involving the lungs and bronchial lymph-nodes as the most advanced lesion of a more or less generalized tuberculosis.

II. Intestinal group:
  1. Tuberculous lesions limited to the mesenteric lymph-nodes.
  2. Tuberculous lesions limited to the intestine and the mesenteric and cervical lymph-nodes.
  3. Tuberculous lesions involving the intestines and mesenteric nodes as the most advanced lesion of a more or less generalized infection.

I. PULMONARY GROUP

It is rather interesting that not one of these young children came to autopsy with tuberculous lesions limited to the lungs, either in the acute or in the healing stage. The complete absence of such a case is evidence that the tendency of tuberculosis in young subjects is toward rapid generalization rather than toward localization and healing. Tuberculosis is a progressive and not a retrogressive process in infants; consequently tuberculous infection in early infancy leads to the death of the infant with comparative rapidity.

1. Tuberculous Lesions Limited to the Bronchial Lymph-Nodes

In five instances the tuberculous lesions were found to be limited to the bronchial lymph-nodes, only one node being involved in each of three cases, and two and three nodes in the other two cases respectively. These children were between 17 and 27 months old (two were 17, two were 18, one was 27 months); that is, they were not young infants—additional evidence that a localized or limited tuberculosis is very rare in early infancy, the tendency at that age being to rapid generalization of the infection. The lesion was an active one in every case, consisting of tubercles with cheesy degeneration of the greater portion of the nodes involved, accompanied in one instance by a small calcareous area within the cheesy mass. There was no evidence of encapsulation of the tuberculous lesion in any one of the affected glands. They were on the right side three times, on the left side once and at the bifurcation of the trachea once. The calcareous nodule was found in the oldest child of this group, a boy of 27 months, who had

undergone an operation for empyema four months before admission to the hospital, where he remained two weeks with unresolved pneumonia and an unhealed empyema. Two of the children died of lobar pneumonia, having given a positive von Pirquet skin test, which was explained at the autopsy by the tuberculous lymph-nodes. Another child died of embryoma of the kidney, and the cheesy lymph-node at the right lung root had not been suspected during life. The fifth case was that of a little girl who died of bronchopneumonia after acquiring esophageal stenosis by drinking strong lye solution. Tuberculosis had not been suspected in her case.

2 (a). Tuberculous Lesions Limited to the Bronchial Nodes and Lung

There were two children in whom the tuberculous lesions were limited to one lung and the adjacent bronchial lymph-nodes. One of these was a 4-months-old girl, the other a boy of 3 years. Both were admitted during the month of August for gastro-intestinal disturbance. Neither gave any family history of tuberculosis. In the older child a von Pirquet skin test gave a negative result, probably because the child was practically moribund at the time the test was made. At the autopsies the unsuspected tuberculous lesions were found, limited in the boy to a small area of cheesy pneumonia with beginning softening in the left lower lobe, and cheesy degeneration of several bronchial lymph-nodes on the left side. The younger child had two cheesy areas, 1 cm. in diameter, in the right apex, with a group of miliary tubercles in the adjacent lung substance and cheesy areas in most of the tracheobronchial lymph-nodes on the right side. These two cases demonstrate the lowered resistance of the young infant and of the older child with even a limited tuberculous lesion, to an attack of gastro-intestinal disturbance. The case of the younger child is also remarkable because of the limitation of tuberculous lesions to the respiratory tract in an infant of 4 months. The fatal intestinal attack evidently occurred before there had been time for generalization.

2 (b). Tuberculous Lesions Limited to Bronchial Nodes and Pia Mater

In the majority of cases, in our experience, tuberculous meningitis in young children is accompanied by tuberculosis of a number of other organs. An exception to this rule in the present series was that of a 27-months-old child who was admitted with the symptoms of tuberculous meningitis. Tubercle bacilli were found in the cerebrospinal fluid, and the von Pirquet test was positive. At the autopsy tubercles were found in the pia mater, and the only other tuberculosis in the body was that in two lymph-nodes at the bifurcation of the trachea. It is difficult to understand why other organs more sensitive to infec-

tion with the tubercle bacillus should have escaped being affected before the pia mater. It will also be noted that this child was in the third year.

2 (c). *Tuberculous Lesions Limited to the Bronchial Nodes and Fingers*

There was but one instance, that of a child 20 months old, who had but one other tuberculous focus besides that in the bronchial lymph-nodes. In this case several fingers were the seat of a dactylitis, apparently tuberculous. But since incision for closer examination was forbidden at the autopsy, positive proof of the nature of the process causing enlargement of the fingers is lacking. A positive von Pirquet skin test was obtained in this child during life.

3 (a). *Tuberculous Lesions of the Lungs and Bronchial Nodes as the Most Advanced Lesion in a Partially Generalized Infection*

As examples of pulmonary tuberculosis with beginning generalization through the blood-stream, we have an 18-months-old child in which there was tuberculosis of the lungs, bronchial lymph-nodes and spleen, and another in which tubercles were found in the liver, spleen and pia mater, in addition to the lungs.

The presence of recent tuberculous ulcers in the intestines in a boy 18 months old with an older infection in the lungs and bronchial glands suggested infection of the intestine through swallowing of tubercle-bacilli-laden sputum rather than blood generalization.

3 (b). *Tuberculous Lesions of the Lungs and Bronchial Nodes as the Oldest Lesion in a Generalized Infection*

By far the greater number of cases in this series fall into the group of primary pulmonary infection with markedly generalized tuberculosis by way of the blood. Thus, 134 of our 178 cases, or 75 per cent., were of this kind, the lesions in the lungs and bronchial lymph-nodes being older than those in any other organ involved. There were 72 cases with the most advanced focus in the right lung, 44 in the left lung, and 18 in which the lesions in both lungs were of equal age. In 40 cases the pulmonary lesion was one of miliary tubercles only, without any sign of cheesy degeneration. The lungs were free from tuberculosis in only 14 of the 178 cases.

Calcareous degeneration was found in the lungs only five times. Twice it was limited to one small nodule in the left apex, twice to the right apex, and in one instance two small calcareous areas, not more than 0.5 cm. in diameter, were present in the left upper lobe. Only two of these five children were less than 2 years old, the youngest 9 months and the oldest 27 months. In the lymph-nodes calcareous

degeneration of a tuberculous focus is rather more common than it is in the lungs, having been found in thirteen cases, in infants from 7 months to 3 years of age. Only two were under a year, four were between 1 and 2 years, and seven were over 2 years old. In twelve cases the bronchial lymph-nodes were the seat of a small calcareous lesion, in one a mesenteric lymph-node alone was affected, and in three cases both bronchial and mesenteric nodes were involved. In eight cases but one node was affected; in five instances from two to five nodes contained small calcareous areas. In no case, however, was the tuberculous lesion entirely calcified or encapsulated; that is, although an attempt to limit or heal the lesion was begun, it proved ineffectual in every instance. The absence of calcareous degeneration from tuberculous lesions of young infants is apparent; its rarity in children from 7 to 12 months is also plain, and finally its increasing frequency during the second and third years must be noted.

Pulmonary cavitation was present in forty-three children coming to autopsy, the location of the cavity varying as follows:

	Right	Left
In the upper lobe	16	14
In the lower lobe	11	6
In the middle lobe	4	0
	31	20

Six children had cavities in two lobes, one child had cavities in three lobes and three children had several small cavities in the same lobe. The cavities varied from 0.5 to 3.0 cm. in diameter, and were the result of softening of an area of cheesy degeneration. Many of them communicated with a bronchus, and the walls were always ragged, irregular, with blood-vessels sometimes present in them, or, rarely, crossing the cavity. The contents of the cavity were usually of a cheesy character, sometimes of grumous material. Pulmonary hemorrhages, probably because of the small size of the vessels present, did not occur in any of our cases. Twenty of the subjects with cavities were less than a year old, the youngest being 3¾ months, our observtions thus confirming the well-known fact that cheesy degeneration in the lungs of these young children takes place and extends rapidly.

The more frequent involvement of the right lung is in keeping with the experience of other observers, and depends on the mechanical fact that the right main bronchus is shorter and straighter than the left.

II. INTESTINAL GROUP

1. Tuberculous Lesion Limited to Mesenteric Lymph-Nodes

But one child presented cheesy tubercles in one mesenteric lymph-node, without any other tuberculous focus in the body. He was 2

years and 10 months old, with no family history of tuberculosis, and entered the hospital for bronchopneumonia, of which he died. He had given a positive reaction to a von Pirquet skin test. That his tuberculous infection occurred through the digestive tract can scarcely be doubted. It must be noted that no case with tuberculosis of the intestines alone or of the intestines and mesenteric glands alone appeared in this series.

2. *Tuberculous Lesions Limited to the Intestine and the Mesenteric and Cervical Nodes*

In one infant, 9 months old, the mesenteric and cervical nodes were equally large and cheesy, while one deep cervical node contained a calcareous area; one tuberculous ulcer was found in the jejunum.

Whether the tubercle bacilli localized first in the intestines or in the lymph-nodes remains unsettled, and is rather immaterial—the point of the case being, that tuberculous infection followed deglutition, and not inhalation. In view of the calcification of the lesion in one cervical lymph-node, it would seem fair to assume that the lesion in this lymph-node was the oldest of the three.

3. *Tuberculous Lesions of the Intestine and Mesenteric Nodes as the Oldest Lesion in a Generalized Tuberculosis*

In two cases the cervical lymph-nodes showed as old a tuberculous focus as that found in the mesenteric nodes and intestines, while the liver and spleen and lungs contained but few young, miliary tubercles. The bacilli evidently were ingested in both these cases, and the cervical glands were infected at the same time as the mesenteric nodes.

Thirteen other cases presented the oldest lesion in the mesenteric lymph-nodes, whence more or less completely generalized infection had occurred. One child of 2 years, besides cheesy tubercles in several mesenteric glands, had miliary tubercles in the liver, peritoneum and pia mater. The involvement of the pia mater before that of the lungs and spleen is noteworthy. Six of the thirteen cases in which the mesenteric glands contained the oldest lesion were accompanied by tuberculous peritonitis. With one exception, a child of 7 months, all the cases of peritonitis occurred in children 21 months to 4 years of age.

Of the entire number of seventeen cases in which tuberculous infection resulted from deglutition and not from inhalation, six were less than a year old; two were 5 months old; one was 7 months; two were 9 months; 1 was 10 months; four were between 1 and 2 years; five were between 2 and 3 years; and two were over 3 years of age. The majority (65 per cent.) of these cases were beyond the nursing

stage, whereas in only 55 per cent. of the cases of respiratory infection were the children over 1 year old.

As for the dissemination of tuberculosis from a focus of ingestive origin, we find that in our series of seventeen cases the lungs were free five times, in three of which the bronchial-lymph-nodes were also free. In eleven children the lungs showed miliary tubercles only, never very numerous and always recent. In one case only were there conglomerate tubercles with areas of cheesy degeneration present in the lungs. This was in a child 21 months old, who showed the only very generalized tuberculosis among all the seventeen cases, ten organs being involved. The intestinal lesions were far older and more

TABLE 1.—

Case No.	Age, Yrs.	Bronchial Nodes	Lungs	Mes. Nodes	Intestines
1	5/12	0	Mil. tubercles	+	+
2	5/12	+	Mil. tubercles	+ +	+
3	7/12	+	Mil. tubercles	+ +	+
4	9/12	+	Very few recent tubercles	+ +	+
5	9/12	0	0	+	+
6	10/12	0	Very recent and few	+ +	+ +
7	1 5/12	+	Mil. tubercles	+ +	0
8	1 5/12	0	Mil. tubercles	+	0
9	1 6/12	0	Mil. tubercles	+	0
10	1 9/12	+	Mil. tubercles and cheesy areas	+ +	+
11	2	+	Mil. tubercles	+ +	+ +
12	2	0	0	+ +	+
13	2	+; 1 Cheesy	0	1 calcareous	0
14	2 10/12	0	0	1 cheesy	0
15	2 11/12	+; 1 calcareous	Mil. tubercles	++ Several calc.	+
16	3	0	Mil. tubercles	+	0
17	4	Early lesions only	0	+	+

extensive than were those of the lungs, and a very severe peritonitis was present.

A child 2 years and 11 months old showed a small calcareous area in one bronchial node, and several mesenterics had similar but larger areas. While the possibility of a simultaneous infection of both groups of lymph-nodes cannot be denied, the fact that there were only a small number of miliary tubercles in the lungs while tuberculous ulcers in the intestines were numerous, large and deep, points to the ingestive lesion as older than the inspiratory one.

Three of the children developed tuberculous meningitis, two having peritonitis as well, one with ten and one with five organs involved.

All the six infants under a year old had severe intestinal ulceration, while six of the older children showed no intestinal lesion. This was especially noteworthy in a child of 3 years with an extensive tuberculous peritonitis and caseation of many mesenteric lymph-nodes. Table 1 shows that marked generalization is not the rule in cases of tuberculosis of ingestive origin.

In two cases infection was traced to a circumcision wound, once in a young infant of 3 months[4] and again in an older boy of 3 years. In both of these cases the oldest tuberculous lesion was in the inguinal glands and all the abdominal viscera as well as the retroperitoneal glands were affected.

—Deglutition Cases

Cervical Nodes	Peritoneum	Liver	Spleen	Kidney	Pia Mater
+	0	+	+	0	0
0	0	+	+	+	0
0	+	+	+	0	0
0	0	+	+	0	0
+	0	0	0	0	0
0	0	+	+	0	0
0	0	+	0	0	0
0	0	+	+	+	0
+	0	+	+	+	0
+	+	+	+	+	+
0	+ +	+	+	0	0
0	+	+	0	0	+
0	0	+	+	+	+
0	0	0	0	0	0
0	0	+	+	+	0
0	+	+	+	0	0
0	+	+	+	0	0

Finally there were thirteen cases in which, at autopsy, the point of entrance of the tubercle bacillus could not be determined with certainty, because pulmonary, intestinal and glandular lesions were equally extensive and advanced.

CASES WITHOUT LUNG INVOLVEMENT

There were only fourteen cases in which the lungs were not involved. Of these, two children were less than a year old (the youngest being 8 months); five were between the ages of 1 and 2 years; seven were over 2 years old.

4. Holt, L. E.: Arch. Pediat., 1913, xxx, 696.

These 14 cases include 5 in which the bronchial lymph-nodes alone were affected; 1 with lesions of the bronchial lymph-nodes and pia mater; 1 with lesions of the bronchial lymph-nodes and fingers; 1 in which the mesenteric glands alone were involved; 2 in which the tuberculous lesions were limited to the bronchial glands, liver, spleen and pia mater; 1 in which the mesenteric glands, peritoneum, liver and pia mater were affected; 1 involving the mesenteric glands, intestines, spleen and cervical glands; 1 involving the mesenteric glands, liver, spleen, kidneys, bronchial glands and pia mater; and 1 with lesions in the mesenteric glands, liver, spleen, intestines, peritoneum and bronchial glands. Table 2 shows these cases at a glance.

TABLE 2.—CASES WITHOUT—

Case No.	Age, Yrs.	Bronchial Nodes	Mesenteric Nodes	Cervical Nodes
1	8/12	Right cheesy; one calcareous area	0	0
2	9/12	0	+	+
3	1 5/12	One on right side cheesy	0	0
4	1 5/12	One on right side cheesy	0	0
5	1 6/12	One on right and one at bifurcation cheesy	0	0
6	1 6/12	One on right and one on left cheesy	0	0
7	1 8/12	One on right side cheesy	0	0
8	2	One on left side cheesy	1 calcareous	0
9	2	0	+	0
10	2 3/12	Two at bifurcation cheesy	0	0
11	2 3/12	One on right calcareous	0	0
12	2 10/12	0	1 cheesy	0
13	4	One on right side cheesy	0	0
14	4	Only early tubercles	+	0

Of these fourteen cases nine were due to infection by inhalation and five to infection by deglutition. Seven of the former were cases in which the lesions were limited to the bronchial glands (or with the pia mater and fingers). Of the other five deglutition cases, in which the primary lesions were found, either in the mesenteric glands or in the intestines, with or without tuberculous peritonitis, one child was 9 months old and the other four were over 2 years. In the respiratory cases the children were somewhat younger, one being 8 months old, five between 1 and 2 years, and three over 2 years.

CASES WITHOUT INVOLVEMENT OF BRONCHIAL LYMPH-NODES

In the entire series of 178 cases there were only nine in which the bronchial lymph-nodes contained no evidence of tuberculosis. In

three the lungs were also free. In the remaining six there were tuberculous lesions in the lungs, but the primary focus was in the gastro-intestinal tract. The youngest of these children was 5¾ months old; the oldest, 3 years.

THE MESENTERIC LYMPH-NODES

The mesenteric lymph-nodes, on the other hand, were the seat of a tuberculous lesion in 113 of the 178 cases. They showed a lesion less advanced than that in the bronchial lymph-nodes in 84 instances, in the same stage of development in 12, and older than the bronchial gland lesion in 17, in 9 of which the bronchial glands were not

—INVOLVEMENT OF THE LUNGS

Intestines	Liver	Spleen	Kidneys	Peritoneum	Pia Mater
0	+	+	0	0	+
+	0	+	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	Fingers +
0	+	+	+	0	+
0	+	0	0	+	+
0	0	0	0	0	+
0	0	0	0	0	0
0	0	0	0	0	0
0	+	+	0	0	+
+	+	+	0	+	0

involved at all, while the mesenteric nodes contained cheesy tubercles. There were only 4 instances of calcareous areas in mesenteric nodes, compared with 12 in bronchial nodes. In only 17 of these 178 cases were the mesenteric gland lesions the most advanced in the body, and in 4 of the 17 the intestines were not involved. The greater frequency of bronchial than of mesenteric gland involvement is apparent.

INVOLVEMENT OF THE MENINGES

Tuberculous meningitis occurred in sixty-nine, or 38 per cent., of these children. The youngest child with tubercles in the pia mater was 2½ months old, and nine were less than 6 months of age; nineteen were between 6 and 12 months, making twenty-eight infants under 1 year who died of tuberculous meningitis, or 38 per cent. of the

tuberculous cases less than a year old in this series. During the second year of life there were twenty-two cases of tuberculous meningitis, or 36 per cent. of the children between 1 and 2 years old having tuberculosis developed meningitis.

TABLE 3.—AGE OF PATIENTS WITH TUBERCULOUS MENINGITIS

2½ months old	1	Under 6 months, 9.	28 under 1 year.
3 months old	3		
4 months old	1		
5 months old	4		
6 months old	5	Between 6 and 12 mos., 19.	
7 months old	3		
8 months old	5		
9 months old	2		
10 months old	4		
11 months old	2		
12 months old	2	Between 12 and 18 mos., 12.	22 between 1 and 2 years.
13 months old	5		
14 months old	1		
16 months old	2		
17 months old	2		
18 months old	4	Between 18 and 24 mos., 10.	
19 months old	1		
20 months old	1		
21 months old	3		
22 months old	1		
Total under 2 years			50
2 years old	12		
3 years old	3		
4 years old	3		
5 years old	1		

A closer study of these cases of tuberculous meningitis is interesting. The comparative frequency with which children under 2 years of age died of meningitis was about the same throughout both halves of the first year (39 per cent. and 38 per cent.), falling to 33 per cent. in the first half of the second year and rising to 40 per cent. during the second half of the second year. In the entire third year of life our series showed that 43 per cent. of children of that age afflicted with tuberculosis died of meningitis. After the third year our numbers were too few to be of value.

The distribution of the lesions in these cases shows that the younger infants tend to have a larger number of viscera involved in the tuberculous process, while in the older children meningitis may follow a very limited infection. Thus the only child which had tuberculous meningitis and but one other tuberculous focus in the body was 27 months old. Five children showed three other tuberculous lesions besides the tubercles in the pia mater, and they were 2 and 4 years old, respectively. No child under 2 years had less than four other tuberculous organs besides the pia mater, only one child under 1 year presented less than five, and no child under 6 months had less than six other tuberculous organs. The largest number of organs involved

was ten, in infants 3 and 5 months old, respectively. Tuberculous lesions in nine organs occurred in two infants 3 months of age. There were eight children with lesions in eight organs, and of these five were under 1 year of age, the other three ranging from 12 to 21 months. Of twenty children presenting seven tuberculous organs besides the pia mater, thirteen were under 1 year, five between 12 and 18 months and two over 3 years of age. To sum up.

Of 14 children with 5 organs involved 1 was under 1 year of age.
Of 15 children with 6 organs involved 5 were under 1 year of age.
Of 20 children with 7 organs involved 13 were under 1 year of age.
Of 8 children with 8 organs involved 5 were under 1 year of age.
Of 2 children with 9 organs involved 2 were under 1 year of age.
Of 2 children with 10 organs involved 2 were under 1 year of age.

28

Of 2 children with 4 organs involved 2 were between 1 and 2 years.
Of 14 children with 5 organs involved 7 were between 1 and 2 years.
Of 15 children with 6 organs involved 5 were between 1 and 2 years.
Of 20 children with 7 organs involved 5 were between 1 and 2 years.
Of 8 children with 8 organs involved 3 were between 1 and 2 years.

22

One child with 1 organ involved was over 2 years old.
Of 5 children with 3 organs involved 5 were over 2 years old.
Of 14 children with 5 organs involved 6 were over 2 years old.
Of 15 children with 6 organs involved 5 were over 2 years old.
Of 20 children with 7 organs involved 2 were over 2 years old.

19

It will readily be seen that the younger infants have a more generalized tuberculosis and the older children a more localized infection. In other words, the younger infants tend to be overwhelmed by the tubercle bacillus, and no immunity develops. In children over 2 years of age there is an increasing tendency toward immunity and consequent limitation of the lesions for a time. The method of infection of the pia mater is undoubtedly by way of the blood-serum.

The most generalized cases had tubercles in the skin, myocardium, peritoneum, mesenteric glands, intestines, kidneys, liver, spleen, bronchial glands, lungs and pia mater. This occurred in two infants, 3 and 5 months of age.

Of these sixty-nine cases of meningitis, three were of intestinal origin: a child of 2 years with tuberculous peritonitis without lung or bronchial gland involvement, another of the same age without lesions in the lungs, but with cheesy degeneration of a bronchial lymph-node, and a child of 21 months with tuberculosis of the lungs and bronchial nodes as well as of all the abdominal viscera.

Whether the bovine type of tubercle bacilli would have been found in the pia mater in these three cases, especially in the one without any

involvement of the thoracic viscera, is an interesting point. Park[5] found two cases of tuberculous meningitis due to the bovine type of tubercle bacillus and two have been found by other observers. Certainly meningitis is far less common among cases of tuberculosis of digestive origin than it is in those following respiratory infection, the proportion in our series being 3 to 17 and 67 to 146, respectively, or 17 per cent. of the digestive cases as compared with 46 per cent. among those due to inhalation of the tubercle bacillus.

In one case meningococci were found in the cerebrospinal fluid during life, and the tubercles were found only at autopsy, the purulent condition of the fluid and the presence of meningococci having dominated the clinical picture, so that a tuberculous complication was not considered.

In another case, tubercle bacilli and influenza bacilli were both present in the fluid, and at post-mortem examination a purulent exudate was found over the cortex of both hemispheres, with tubercles in the pia over the cortex and base. This case has been reported by Dr. Faber.[6]

Solitary tubercles in the cerebral hemispheres were present in two cases, one of which had a cheesy mass in the right occipital lobe, another in the right frontal lobe and a third in the cerebellum. These tubercles measured 1 to 1.5 cm. in diameter, and in consequence the lesion in the brain was as extensive as that in the lungs.

YOUNGEST PATIENTS

It is interesting to note that our series comprises two infants who were but 2½ months old. In one of these the mother was tuberculous and the child died of tuberculous meningitis, showing at autopsy a generalized infection involving eight organs, with cheesy pneumonia in one lung.

In the other case the father was dying of pulmonary tuberculosis at the time of the child's admission. Autopsy on this infant showed tubercles in the lungs, liver, spleen, kidneys, intestines, mesenteric and bronchial lymph-nodes. Both these cases were of respiratory origin.

Six children were 3 months of age, and of these three died of tuberculous meningitis. In one the tuberculous infection followed circumcision, and the inguinal lymph-nodes were large and cheesy. In the other five young infants the primary lesion was in the lung and was accompanied by generalized infection. The myocardium con-

5. Park and Krumweide: Collected Studies from the Laboratories, Board of Health, New York, 1912-13, vii, 88.

6. Faber, H. K.: A Case of Tuberculous Meningitis Complicated by Influenzal Meningitis, Am. Jour. Dis. Child., 1914, viii, 150.

tained one or two tubercles in two of the six infants 3 months old, while in the entire series of 178 cases the heart muscle was involved only ten times; which further proves the tendency to generalization of infection in these young infants.

DISCUSSION

The largest number of our cases were of inhalation origin, as shown by the large percentage of cases in which the pulmonary lesions were the most advanced in the body. The absence of tuberculous lesions from the lungs in fourteen cases and the presence of tuberculous lesions in the bronchial lymph-nodes in seven of these seems to show that it is possible for the tubercle bacillus to pass through the lungs without localizing there.

The inhalation origin of the majority of cases of tuberculosis corresponds with the findings of A. Ghon,[7] who analyzed 184 cases and found the primary lesion in the lung in all but fourteen. These cases, however, comprise children up to the age of 14, and he does not state what percentage of them were less than 3 years old. Therefore, our results are not really comparable.

It seems to us that Ghon is stretching a point in his discussion of these fourteen cases when he says that while he was unable to find a pulmonary lesion in seven, he prefers to consider that he overlooked it rather than that it was not there. We prefer to look on similar cases in our series as primary localization in the bronchial glands, the tubercle bacillus having passed through the lung without localizing there. We must agree with Ghon's final conclusion that in children the primary infection of the lung is the usual mode of infection, for 82 per cent. of our cases were of this type.

The marked tendency to rapid and general dissemination of the tuberculous lesions throughout the body in infants less than a year old is well shown. In view of that fact the survival of any young infant infected with tuberculosis for more than six months after infection is very remote, while healing of tuberculous lesions in young infants is practically out of the question. In our entire series not a single healed tuberculous lesion was encountered, and attempts at healing, shown by calcified areas, were found only five times in the lung and thirteen times in lymph-nodes. Only twice was it found among infants less than a year old, and in both these cases the extensive generalization of tubercles throughout the body gave evidence that the small calcareous areas present did not prevent spreading of the infection.

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7. Ghon, Anton: Der primäre Lungenherd bei der Tuberkulose der kinder, Urban and Schwarzenberg, Berlin and Vienna, 1912.

Encapsulation of a tuberculous lesion was not encountered in this series of cases.

The predominance of respiratory over deglutition infection is indirect evidence of the quality of our milk-supply, though it must not be forgotten that children may carry tubercle bacilli into their mouths by means of fingers infected by contact with dirty floors and furniture, as well as by means of food.

The comparative frequency of tuberculous meningitis in young infants is noteworthy, as evidence of the very general dissemination of tuberculous lesions in these young subjects.

The smaller proportion of cases of tuberculous meningitis among the children who acquire tuberculosis by ingestion as compared with those who become infected by inhalation, is in keeping with the fact that the deglutition cases show rather less tendency to generalization than do the respiratory cases.

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RECURRENT MENINGITIS, DUE TO LEAD, IN A CHILD OF FIVE YEARS*

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The case was seen in Dr. Howland's service in the Harriet Lane Home of the Johns Hopkins Hospital. It was that of a boy, between 5 and 6 years old, who was admitted Aug. 22, 1913, having been transferred from the Home of the Friendless in a state of coma.

Little was learned of his early history except that he had had in the eight preceding months two attacks of otitis media, and that for two years he had been subject to rather frequent and severe bleedings from the nose.

He seemed as well as usual up to five days before admission, when he began to complain of pain in his face and head, to be restless at night, and to look ill. The next day stiffness of the neck was noted, and the child vomited on several occasions. He became rapidly worse, and convulsions and coma developed the day before he was brought to the hospital.

On admission he was comatose. His head was retracted, and his arms and legs were extended and spastic. Kernig's sign was, however, not present. There were recurrent, general convulsions. The left eye was deflected inward. The child's temperature was practically normal. There was a leukocytosis of 27,600.

Spinal puncture was done on four occasions — directly after admission, the next day, then in three days, and after an interval of two weeks. The results of these punctures were all very similar, except that the pressure, which was very high on the first occasion, was not above normal on the subsequent punctures. The fluid was always clear and sterile. It contained from twenty to forty cells, mostly mononuclear. It was positive to the Noguchi globulin test, reduced Fehling's solution, and the Wassermann reaction was negative.

The von Pirquet skin test was negative.

The right optic nerve was swollen and its edges obscured. There were numerous hemorrhages in the retina about it. The left optic nerve was practically normal. As noted on admission, the left external rectus was weak. There was nothing else abnormal discovered in the nervous system.

The convulsions, the rigidity of the neck, the optic neuritis, and the spinal fluid findings, suggested a meningitis. It was considered to be a serous meningitis of unknown cause.

Improvement began after the first lumbar puncture, and in a week the patient seemed nearly well, complaining only of headache at night, abdominal pain, and occasionally vomiting. He was discharged September 20, after an examination which revealed nothing abnormal. The spinal fluid, however, showed an increase in the cells and a positive globulin test. The right optic nerve was reported by the ophthalmological department to be quite normal, although there was some difference of opinion in regard to this.

The child was returned to the care of the Home of the Friendless, but was seen from time to time in the out-patient department. The condition remained excellent for five months.

In January, 1914, he had a number of attacks of epistaxis, for which he was treated in the throat department.

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*Read at the Annual Meeting of the American Neurological Association held at Albany, New York, May 9, 1914.

On March 1 he began to suffer from headache and vomited. The convulsions recurred and in two days he was again in coma. He was readmitted to the Harriet Lane Home on March 3, in a condition which was almost identical to that of his first admission, six and a half months before. The neck was stiff but there was no definite Kernig sign, and the limbs were not held so stiffly as on the former admission. There was choked disk on the right side, with some retinal hemorrhages; on the left side the disk was sharp-cut — indeed, looked slightly atrophic. He had moderate anemia, hemoglobin of 55 per cent., red blood-cells 4,480,000, white blood-cells 23,100. Lumbar puncture yielded fluid very similar to that found at first admission. The fluid, however, did not seem to be under any noticeably increased pressure.

The recurrence of such a condition naturally aroused a great deal of interest, and the case was studied most carefully from every side. Nothing, however, was discovered that threw light on the etiology, until our attention was attracted to a slight discoloration about a tooth, and a more careful inspection revealed the presence of a very fine but typical lead-line on the gums surrounding many of the teeth. The blood showed well-marked stippling of the red cells (Grawitz's granules), and confirmed us in our view that poisoning by lead was the cause of the trouble.

The urine was examined but no lead was demonstrated in it.

We were much puzzled as to the source of the lead, until he was found with his mouth covered with white lead paint which he had bitten from the railings of his crib. Before this discovery we had investigated the conditions and the other inmates of the institution in which he lived and had found nothing that aroused our suspicion, but the fact that the white paint on the patient's bedstead in the dormitory was chipped off much more than from the others.

After we knew of his peculiar habit, we found that he would gnaw any painted object unless he was most carefully watched.

In this second attack he developed a weakness of the external rectus muscle — this time of the right eye — three or four days after his entrance to the hospital, and he complained from time to time of abdominal pain.

The patient again made a remarkably quick and uneventful recovery. He was discharged on May 1, having been up and around the ward for more than a month, quite recovered except for the persistence of an increase in cells and positive globulin reaction in the spinal fluid.

He remained in good health for three weeks when on May 25 he had a severe convulsion and died. No post-mortem examination was obtained.

Lead-poisoning in children does not seem to be very common, although it is well recognized. That there is a special form of meningitis due to lead has been insisted on only by the French observers. That lead affects the central nervous system has been long known, and in certain fatal cases of lead encephalopathy anatomic changes have been noted in the meninges together, at times, with increase of the fluid in the ventricles or in the subarachnoid space. Felix Aussendorf[1] has collected reports of a number of such cases, among them Spiller's[2] important case.

French clinicians, true to their historic interest in lead poisoning, have, in the last ten years, been much occupied as to the effects of the metal on the brain and its coverings. Among the numerous articles

1. Aussendorf, Felix: Zur Kenntnis der pathologischen Anatomie des Zentralnervensystems bei Encephalopathia saturnina. Inaug. Diss., Leipsic, 1911.
2. Spiller: Jour. Med. Research, August, 1903, x, No. 1.

those written by Mosny, in association with several collaborators, are the most important. In the chief of these, Mosny and Malloizel[3] give the histories of forty-seven cases of lead-poisoning, mostly from their own experience, in almost all of which lumbar punctures were done and the cerebrospinal fluid studied.

They point out that in acute lead colic there is very generally evidence of involvement of the meninges as shown by the fact that the cerebrospinal fluid contains an increased number of cellular elements, mostly lymphocytes. In these so-called abortive cases (*la méningite fruste*) the only symptom of such meningeal irritation may be headache, but the severity of this is not always proportionate to the laboratory findings.

In chronic lead-poisoning they rarely found any change in the cerebrospinal fluid.

In other cases classed as acute lead meningitis, the symptoms of involvement of the central nervous system are pronounced. In these the meningeal reaction, as revealed by lumbar puncture, is always very marked, persistent, and may be as intense as in tuberculous meningitis. It is in this group that our case would be classed, together with many cases of the so-called lead encephalopathy.

Mosny and Malloizel feel that the term "lead encephalopathy" is far too general, and they have attempted to divide the cases into more definite clinical groups, in all of which, however, there is more or less evidence of involvement of the meninges, as shown by the results of spinal puncture.

It is to be regretted that there is no record in their excellent article of any ophthalmoscopic examination.

Plate[4] reports a typical clinical case of lead meningitis in a young man of 20. Four lumbar punctures were done, giving a decreasing cell-count from 90 to 14. The author thinks his is the first case reported in Germany.

Mass[5] reports a number of cases in which the diagnosis of acquired hydrocephalus, due to serous meningitis, was made, and in which he thought he could assume lead as the cause. These cases were seen in the chronic stage or at necropsy, and in none of them was lead proved to be more than a possible etiological factor.

Involvement of the optic nerves and of the motor nerves of the eyeballs in the course of lead-poisoning, although certainly not fre-

3. Mosny and Malloizel: La méningite saturnine, 1907, xxvii, 506.

4. Plate: Ueber einen Fall von Meningitis saturnina, München. med. Wchnschr., 1913, lx, 2343, 2345.

5. Mass: Ueber eine besondere Form der Encephalopathia saturnina (Meningitis serosa), Monatschr. f. Psychiat. u. Neurol., 1911, xxx, 207.

quently noted in America, is well known. Wilbrand and Saenger[6] have collected reports of most of the cases. It would seem that optic neuritis may occur primarily, or through the direct toxic action of lead on the nervous system, or by the production of interstitial neuritis, or through the alterations of the blood-vessels in the retina and optic nerves, or secondarily through intercranial changes or changes in the kidney. Paralysis of one or more of the external eye muscles is not infrequently associated with optic neuritis, or may occur alone.

J. Lockhart Gibson[7] has for a number of years repeatedly called attention to a most remarkable group of cases seen in children of Queensland, Australia. The case which we have reported seems closely allied to these. In that country children in general seem peculiarly liable to lead-poisoning, and perhaps especially to its effects on the eyes. Gibson has seen as many as nine cases of what he calls plumbic ocular neuritis in a single year. This condition usually affects children below the age of 8, and is characterized by the development of squint, due to weakness of one or both external recti, and associated with marked optic neuritis. There is often no other symptom of lead-poisoning, but at times more serious symptoms of lead encephalopathy are present. Gibson believes the source of the lead to be usually due to the children's getting dried paint from the railings of long-painted verandas or garden fences on their hands and then into their mouths. Children who suck their fingers or bite their fingernails are more liable to the disease. He regards the condition as a neuritis, but points out in his last article the great importance of an early lumbar puncture, and the almost constant finding of an increased pressure in the cerebrospinal fluid. He regards the withdrawal of the fluid as the essential therapeutic measure, surely indicating that meningeal irritation must be an essential factor in the condition.

We have found no record of any examination of the withdrawn fluid, either chemically or microscopically.

The case which we have reported, the results of lumbar punctures in acute lead colic, the results of certain of the autopsies of patients dying of lead encephalopathy, the cases reported by Gibson, all force us to the conclusion that lead appears to have a special effect on the meninges and the central nervous system, and that it may not infrequently be the unsuspected cause of so-called serous meningitis.

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6. Wilbrand and Saenger: Die Neurologie des Auges, 1913, v.
7. Gibson, J. Lockhart: Australian Med. Gaz., 1897 to 1912; Brit. Med. Jour., 1908.

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